United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with the
Texas Agricultural
Experiment Station and
Texas State Soil and
Water Conservation
Board

Soil Survey of Lavaca County, Texas

How To Use This Soil Survey

General Soil Map

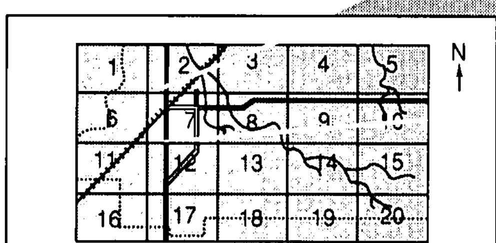
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

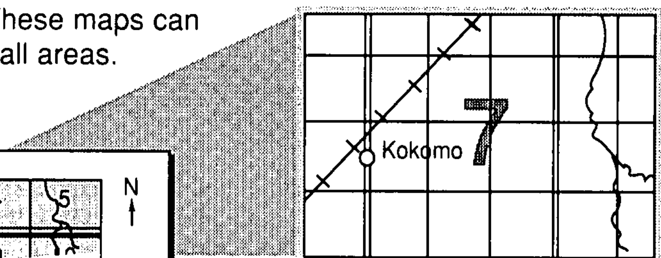
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



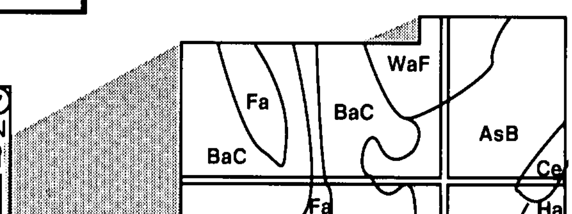
INDEX TO MAP SHEETS



MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.

MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This soil survey was made cooperatively by the Soil Conservation Service, the Texas Agricultural Experiment Station, and the Texas State Soil and Water Conservation Board. It is part of the technical assistance furnished to the Lavaca Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Cattle grazing coastal bermudagrass in an area of Straber loamy sand, 1 to 5 percent slopes. Post oak and cedar trees dominate the vegetation in the background.

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Issued December 1992

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Lavaca County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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Soil Survey of
Lavaca County, Texas

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Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Texas Agricultural Experiment Station and Texas State Soil and
Water Conservation Board

LAVACA COUNTY is in the southeastern part of Texas (fig. 1). It has an area of 971 square miles, or 621,536 acres. Hallettsville is the county seat. Other major towns in the county include Yoakum, Shiner, and Moulton. There also are many small communities that have a population of less than 200. In 1980, the total population of the county was 19,004.

Most of the county is gently rolling. Some nearly level areas are in the southern part. Elevation ranges from about 100 feet above sea level in the southern part of the county to 560 feet in an area southwest of Moulton, near the Gonzales County line. Some well defined creeks and rivers dissect various parts of the county. The northwestern and central parts of the county are drained by the Lavaca River and its tributaries. The Navidad River dissects the eastern part of the county. Major streams that drain into the Lavaca River include Smothers, Ponton, Rocky, Mustang, Clarks, Supplejack, Brushy, and Chicolete Creeks. Major tributaries of the Navidad River include Big Rocky, Honey, Mixon, Sandies, Ragsdale, and Hardy's Sandy Creeks.

The major land uses in Lavaca County are cattle ranching and farming. In 1985, about 51 percent of the county was used as rangeland, 37 percent as pastureland or hayland, 10 percent as cropland, and 2 percent as urban or built-up land. Since there are no major lakes in the county, most municipal and industrial water is from underground sources. Water wells are the main source of irrigation water for rice fields in the southern part of the county.

Lavaca County is in the Texas Blackland Prairie, Texas Claypan Area, and Gulf Coast Prairies Major Land Resource Areas. The clayey and loamy soils of

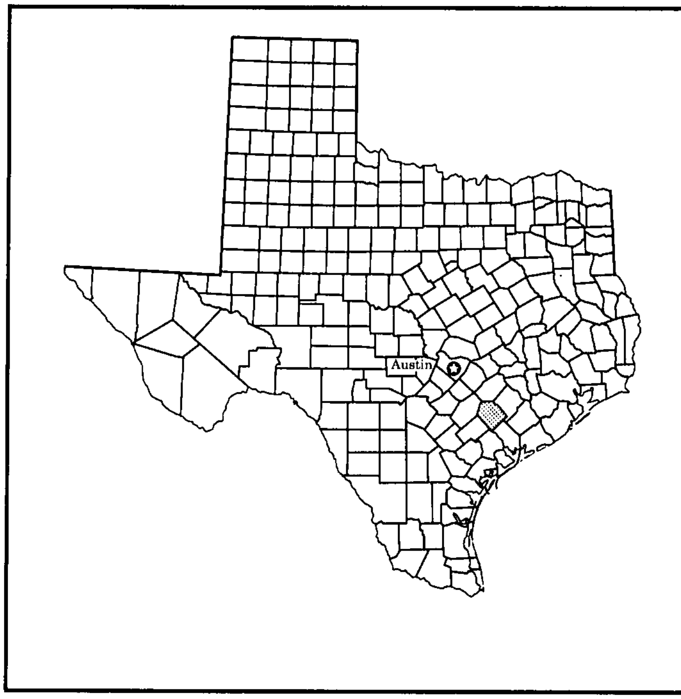

Figure 1.—Location of Lavaca County in Texas.

the Texas Blackland Prairie formed under prairie vegetation and are dominantly dark in color. These soils are mainly in the northern and western parts of the county. The sandy and loamy soils of the Texas Claypan Area formed under post oak savannah vegetation and are dominantly light in color. These soils are mainly in the southwestern and south-central parts

of the county. The loamy and sandy soils of the Gulf Coast Prairies formed under somewhat poorly drained or poorly drained conditions and are dominantly light in color. These soils are mainly in the extreme south-southeastern part of the county.

Erosion control is the main management concern for many soils in the survey area. The gently sloping and sloping soils are susceptible to sheet and gully erosion if they are not protected. Surface drainage is a management problem for some nearly level, slightly concave soils of the Gulf Coast Prairies.

Descriptions, names, and delineations of the soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of a better knowledge of soils, modifications in soil series concepts, the intensity of mapping, or the extent of soils within the survey area.

This survey updates the soil survey of Lavaca County published in 1905 *(21)*.

General Nature of the County

The paragraphs that follow give general information about Lavaca County. They describe history, agriculture, natural resources, and climate.

History

The early settlement of the area that is now Lavaca County began in the late 1820's. The Lavaca River, one of two rivers in the county, was called Les Veches by the French explorer, LaSalle. The Spaniards translated the name of the river to La Baca, which was changed to Lavaca when the county was established in 1846 *(6)*.

The Lavaca River was the boundary between two principal Texas colonies, Austin and DeWitt. Land grants were given to settlers on the banks and tributaries of both the Lavaca and Navidad Rivers. Migration to this area was steady except during the Texas Revolution. Hallettsville, the county seat, was named after Margaret Hallett, widow of John Hallett. Mrs. Hallett donated land for the town site of the "Hallett League" settlement *(7)*.

Early agriculture consisted of large plantation-type farms and large cattle ranches. These farms and ranches were mostly in the southern and central parts of the county. The Anglo-American settlers preferred farming the sandy and sandy loam soils and bottom land. Cotton and corn were the main crops. The labor for many plantations was supplied by slaves. Cotton was transported to Port Lavaca for shipping. In later years it was transported to Houston.

The number of livestock increased greatly in the 1850's. Cattle were driven to markets in Galveston or Indianola or to smaller local markets. Raising sheep was popular from 1870 to 1890; however, by 1900, the number of sheep had greatly declined.

In the 1870's and 1880's, many European immigrants began to settle in the county. They were primarily from Czechoslovakia and Germany. They settled on small farms in the northern part of the county where they preferred farming the dark prairie soils in the Texas Blackland Prairie. These farmers provided diverse agricultural products.

Although cotton continued as the major crop in the 1890's, the production of corn and truck crops was widespread. Also, dairying and poultry production were common. The variety of agricultural industries has helped Lavaca County to remain self sustaining.

Agriculture

Agriculture in Lavaca County began to change in the early 1900's. Since that time, livestock production has increased and row-crop farming has declined. Because of crop damage caused by the boll weevil, cotton production has decreased. Prices received for cotton, grain, and vegetables have been extremely variable since World War I. Large amounts of soil have been lost because of water erosion. This erosion has mainly occurred on soils of the Texas Blackland Prairie. Some deep gullies, which were also caused by erosion, are on the sandy soils of the Texas Claypan Area.

The introduction of new breeds of cattle was a major factor in raising livestock. Improved breeds of beef cattle first included Brahman, Hereford, and Shorthorn. In recent years other new breeds of beef cattle have been introduced in the county. New dairy cattle breeds in the early 1900's included Jersey and Holstein. Two milk-processing plants were active through World War II. Poultry production, not common at the present time, was a major industry in Lavaca County in the early 1900's.

In the past 50 years, many idle fields have been planted or sprigged to improved pasture grasses. These grasses include improved bermudagrasses, such as Coastal and Alicia, Gordo bluestem, bahiagrass, Alamo switchgrass, and kleingrass. Many old fields, which are now infested with dense stands of huisache or mesquite, have good potential for pasture grasses.

Dryland grain sorghum, corn, and small grain are produced on many farms in the Texas Blackland Prairie. Irrigated rice is grown extensively on Gulf Coast Prairie soils. Sudan hybrids are planted throughout the county for hay and pasture. Only one or two fields of cotton are farmed, and there are no active cotton gins in the county.

Pecan production is becoming a major industry in the county. Many native trees have been grafted with improved varieties of pecans, and several new pecan groves have been established.

Natural Resources

Soil is the most important natural resource in Lavaca County. The production of livestock, crops, and forage, which are sources of livelihood for many people in the county, all depend on the soil.

Natural gas and oil production is significant and is related to the local geology. The geological formations in this part of Texas are in broad bands that are parallel to the Gulf of Mexico. These formations are dissected by faults that dip toward the gulf. These faults trap reservoirs of natural gas and oil. Land leasing, exploring for gas and oil, and drilling and servicing gas and oil wells are common enterprises in various parts of the county. They provide employment for county residents and revenue for local landowners.

Water is another important resource. Underground aquifers provide water for municipal, industrial, and agricultural uses.

Wildlife, especially deer and waterfowl, are valuable resources in the county. Deer are plentiful in many areas. Leasing land for deer hunting provides a large amount of revenue for local landowners. Geese and ducks migrate by the thousands to the Gulf Coast Prairie soils. Rice fields and other poorly drained areas provide food and nesting areas.

In contrast to many adjacent counties, Lavaca County has very little gravel to be mined. However, there are several sandstone pits in the northern half of the county. This weakly cemented sandstone is used mostly in the construction of local roads.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Lavaca County is hot in summer and cool in winter when an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfall is infrequent. The total annual precipitation is usually adequate for cotton, feed grain, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Hallettsville, Texas, in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 55 degrees F and the average daily minimum temperature is 43 degrees. The lowest temperature on record, which occurred at Hallettsville on February 2, 1951, is 6 degrees. In summer, the average temperature is 83 degrees and the average daily maximum temperature is 95 degrees. The highest recorded temperature, which occurred at Hallettsville on July 17, 1980, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 39 inches. Of this, 23.40 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 6.75 inches at Hallettsville on September 12, 1980. Thunderstorms occur on about 49 days each year.

The average seasonal snowfall is less than 1 inch. The greatest snow depth at any one time during the period of record was 2 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 65 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 12 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration, and the pattern of damage is variable and spotty.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface

down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar)

inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Dominantly Gently Sloping, Sandy and Loamy Soils of the Texas Claypan Area

These soils make up about 52 percent of the county. Denhawken, Dubina, Elmendorf, Hallettsville, Straber, and Tremona are the major soils. They formed mainly in clayey and loamy sediments of the Fleming, Goliad, and Willis Formations. The landscape is undulating to gently rolling and has a well defined drainage pattern.

These soils are used mainly as rangeland or improved pasture. A few areas are used as cropland. The native range plants are mid and tall grasses mainly in a post oak and live oak savannah. Coastal bermudagrass is the main improved pasture grass. Grain sorghum and corn are the main crops.

Most of these soils are highly erodible and have a clayey subsoil that restricts the movement of water and the growth of roots. Fertilizer is needed for good crop yields.

These soils have some limitations as sites for urban and industrial uses. The main limitations are a high shrink-swell potential, restricted permeability, and a corrosive effect on unprotected steel.

1. Straber-Tremona

Somewhat poorly drained, very slowly permeable, sandy soils; on uplands

These soils are on broad convex slopes, low ridges, and upland stream divides. Slope ranges from 1 to 5 percent. The Straber soils are on the smoother parts of the landscape. They are transitional to loamy soils. The Tremona soils commonly have a gently undulating surface. This unit has more woody vegetation than any other unit in the county. Large post oak and live oak trees are common. The number of invading yaupon varies. There are some deep gullies. About 25 percent of the acreage in this unit has been cleared. Many fields that were once cultivated are now used for improved pasture.

This map unit makes up about 29 percent of the county. It is about 41 percent Straber soils, 39 percent Tremona soils, and 20 percent soils of minor extent (fig. 2).

Typically, the Straber soils have a surface layer of brown loamy sand about 7 inches thick. The subsurface layer, from a depth of 7 to 14 inches, is very pale brown loamy sand. The subsoil is brownish yellow clay from a depth of 14 to 23 inches, reddish yellow sandy clay from a depth of 23 to 34 inches, light gray sandy clay from a depth of 34 to 52 inches, and light gray sandy clay loam from a depth of 52 to 62 inches. The substratum, from a depth of 62 to 80 inches, is light gray sandy clay loam. The subsoil and substratum are mottled in shades of red, brown, or yellow.

Typically, the Tremona soils have a surface layer of light brownish gray loamy fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 27 inches, is very pale brown loamy fine sand. The subsoil is light gray sandy clay from a depth of 27 to 61 inches and light gray sandy clay loam from a depth of 61 to 80 inches. It has mottles in shades of red or yellow throughout.

Of minor extent in this map unit are Catilla, Denhawken, Dietrich, Dubina, Dutek, Elmendorf, Hallettsville, Navidad, Pulexas, and Pursley soils. Catilla soils are deep and sandy. They are mainly in the lower

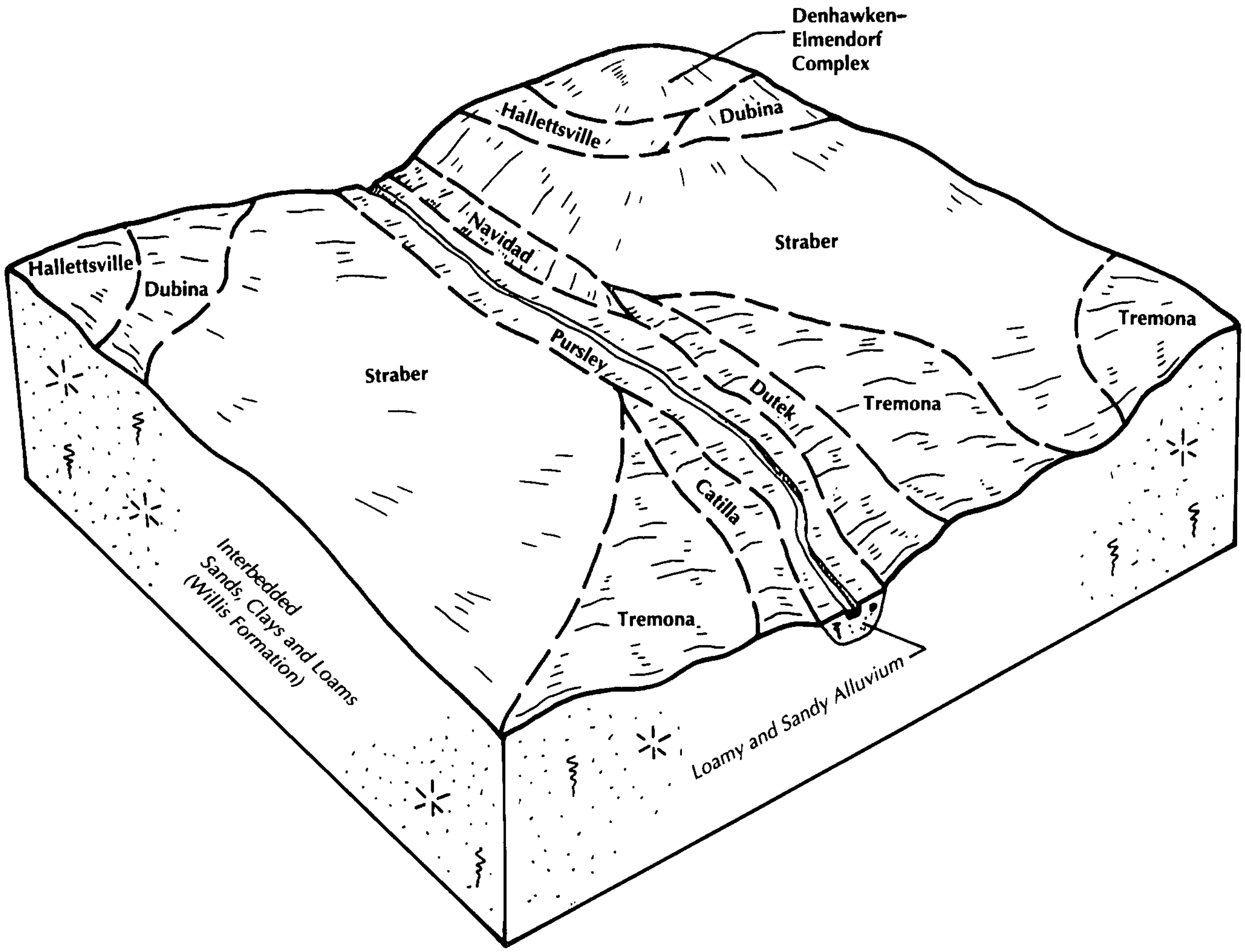

Figure 2.—Typical pattern of soils and parent material in the Straber-Tremona map unit.

landscape positions. Denhawken and Elmendorf soils are well drained and loamy. They are mapped in a complex on the higher ridges. Dietrich and Dutek soils are on stream terraces. Dietrich soils have a high content of sodium. Dutek soils are sandy and well drained. Dubina and Hallettsville soils have a dark surface layer. They are in the nearly level lower areas. Navidad, Pursley, and Pulexas soils are loamy. They are on flood plains.

The major soils are used mainly as rangeland. Some areas are used for improved pasture grasses, such as bermudagrass and bahiagrass. There are a few small cultivated fields. The main crops are grain and forage sorghum. Careful management is needed to control wind erosion and water erosion. Yields of crops and forage are medium or low, depending on management practices.

The major soils have some limitations as sites for urban and industrial uses. These limitations include a high shrink-swell potential, the very slow permeability, and a highly corrosive effect on underground steel pipe. These limitations can be partly overcome by proper design and installation of building foundations, septic tank absorption fields, pipelines, and roads.

The major soils are suited to most recreational uses; however, careful management is needed to control wind erosion and water erosion. The loose, sandy surface layer restricts some uses. Because of the woody vegetation on these soils, the potential for wildlife habitat is good. Deer hunting is common in areas of these soils.

2. Denhawken-Elmendorf-Hallettsville

Well drained and moderately well drained, very slowly permeable, loamy soils; on uplands

These soils are on broad convex slopes, low ridges, and upland stream divides. Slope ranges from 1 to 3 percent. The Denhawken and Elmendorf soils are mapped in a complex, which has a distinct pattern of light-colored elongated ridges and dark valleys that extend from the upper to the lower slopes in a parallel pattern. The Denhawken and Elmendorf soils are mainly on the upper slopes and broad ridges. They support open prairie vegetation. The Hallettsville soils are on the lower slopes. They are mainly wooded. About 70 percent of the acreage in this unit has been cleared. Many fields that were once cultivated are now used for improved pasture.

This map unit makes up about 14 percent of the county. It is about 26 percent Denhawken soils, 22 percent Elmendorf soils, 20 percent Hallettsville soils, and 32 percent soils of minor extent (fig. 3).

The Denhawken soils are well drained. Typically, the surface layer is grayish brown clay loam about 6 inches thick. The subsoil is light brownish gray clay loam from a depth of 6 to 22 inches and very pale brown clay from a depth of 22 to 43 inches. The substratum, from a depth of 43 to 80 inches, is very pale brown to pink clay.

The Elmendorf soils are well drained. Typically, the surface layer is very dark gray sandy clay loam about 12 inches thick. The subsoil is very dark gray clay loam from a depth of 12 to 25 inches and dark gray clay from a depth of 25 to 54 inches. The substratum, from a depth of 54 to 80 inches, is gray clay.

The Hallettsville soils are moderately well drained. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsoil is dark gray sandy clay from a depth of 8 to 13 inches,

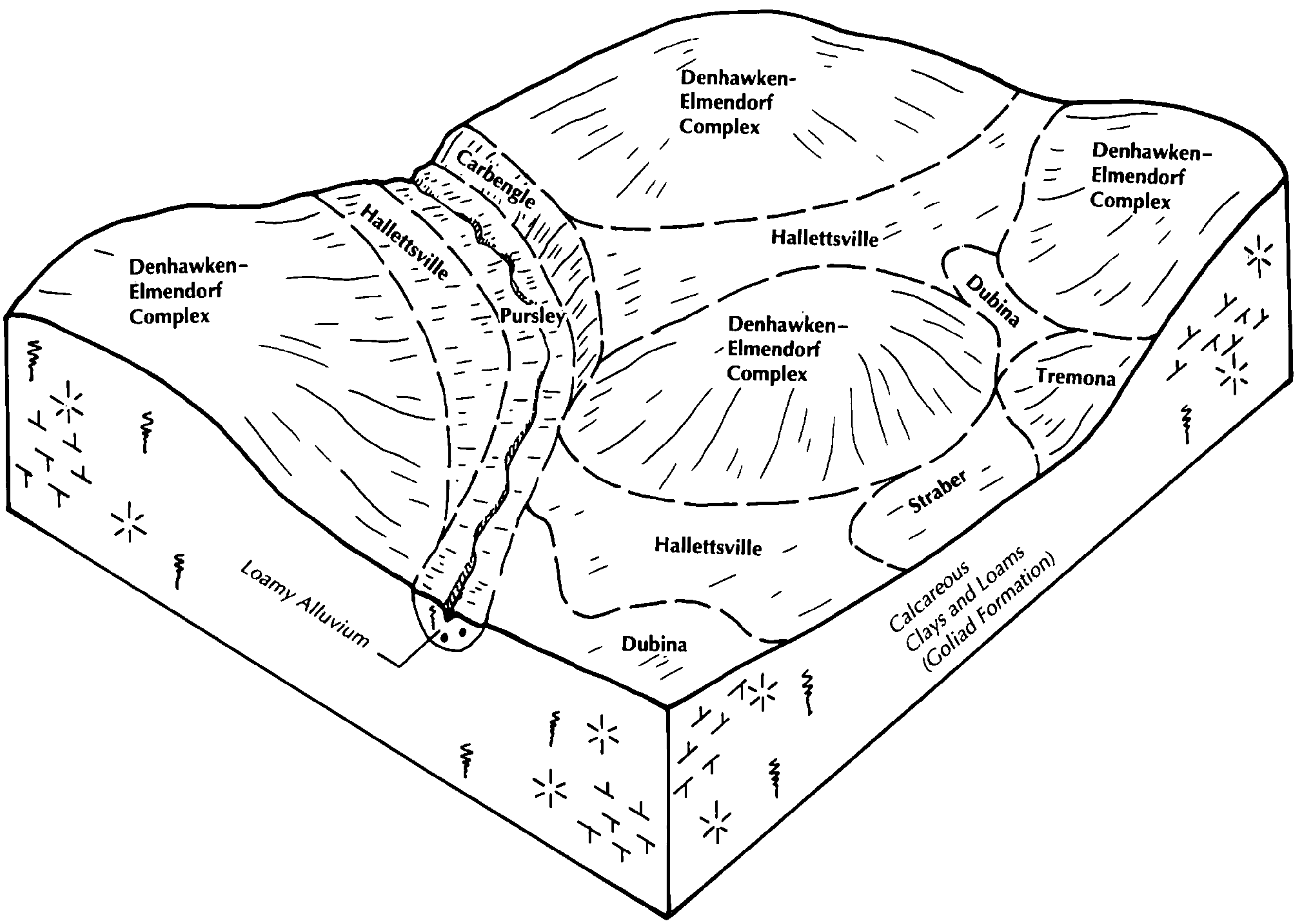

Figure 3.—Typical pattern of soils and parent material in the Denhawken-Elmendorf-Hallettsville map unit.

grayish brown sandy clay mottled in shades of brown from a depth of 13 to 35 inches, grayish brown and light brown sandy clay loam from a depth of 35 to 54 inches, and white sandy clay loam mottled in shades of brown, yellow, or red from a depth of 54 to 74 inches. The substratum, from a depth of 74 to 80 inches, is light yellowish brown fine sandy loam that has very pale brown mottles.

Of minor extent in this map unit are Carbengle, Dubina, Frelsburg, Pursley, Straber, and Tremona soils. Carbengle soils are in the more sloping areas. They are underlain by sandstone. Dubina, Straber, and Tremona soils have a sandy surface layer. Frelsburg soils have a clayey surface layer. Pursley soils are on flood plains along streams.

The major soils are used mainly as improved pasture or rangeland. Some areas are used as cropland. The main crops are corn and grain sorghum. Careful management is needed to control water erosion. Yields of crops and forage are medium or high, depending on management practices.

The major soils have some limitations as sites for urban and industrial uses. These limitations include a high shrink-swell potential, the very slow permeability, and a corrosive effect on unprotected steel pipe. These limitations can be partly overcome by proper design and installation procedures.

The major soils are suited to most recreational uses. The potential for wildlife habitat is good, especially in areas of the Hallettsville soils. Deer hunting is common in areas of the Hallettsville soils.

3. Dubina-Hallettsville-Straber

Moderately well drained and somewhat poorly drained, slowly permeable and very slowly permeable, sandy and loamy soils; on uplands

These soils are on foot slopes, low ridges, and upland stream divides. Slope ranges from 1 to 3 percent. The Dubina and Straber soils are mainly in the slightly higher, convex areas. The Hallettsville soils are in the lower, slightly convex or plain areas. About 65 percent of the acreage in this unit has been cleared. Many fields that were once cultivated are now used for improved pasture.

This map unit makes up about 9 percent of the county. It is about 36 percent Dubina soils, 26 percent Hallettsville soils, 17 percent Straber soils, and 21 percent soils of minor extent.

The Dubina soils are moderately well drained and slowly permeable. Typically, the surface layer is dark grayish brown loamy fine sand about 11 inches thick. The subsoil is dark grayish brown sandy clay from a depth of 11 to 17 inches, brown sandy clay from a depth of 17 to 33 inches, light brownish gray sandy clay loam from a depth of 33 to 43 inches, strong brown sandy clay loam from a depth of 43 to 61 inches, and brown sandy loam from a depth of 61 to 69 inches. The subsoil is mottled in shades of brown, red, yellow, or gray. The substratum, from a depth of 69 to 80 inches, is white loamy sand.

The Hallettsville soils are moderately well drained and slowly permeable. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsoil is dark gray sandy clay from a depth of 8 to 13 inches, grayish brown sandy clay mottled in shades of brown from a depth of 13 to 35 inches, grayish brown and light brown sandy clay loam from a depth of 35 to 54 inches, and mildly alkaline or moderately alkaline, white sandy clay loam mottled in shades of brown, yellow, or red from a depth of 54 to 74 inches. The substratum, from a depth of 74 to 80 inches, is light yellowish brown fine sandy loam that has very pale brown mottles.

The Straber soils are somewhat poorly drained and very slowly permeable. Typically, the surface layer is brown loamy sand about 7 inches thick. The subsurface layer, from a depth of 7 to 14 inches, is very pale brown loamy sand. The subsoil is brownish yellow clay from a depth of 14 to 23 inches, reddish yellow sandy clay from a depth of 23 to 34 inches, light gray sandy clay from a depth of 34 to 52 inches, and light gray sandy clay loam from a depth of 52 to 62 inches. The substratum, from a depth of 62 to 80 inches, is light gray sandy clay loam. The subsoil and substratum are mottled in shades of red, brown, or yellow.

Of minor extent in this map unit are Carbengle, Cuero, Denhawken, Elmendorf, and Tremona soils. Carbengle and Cuero soils are on the slightly higher convex slopes. They are underlain by sandstone. Denhawken and Elmendorf soils are mapped in a complex on the higher ridges. Tremona soils are in landscape positions similar to those of the Straber soils. They have a sandy surface layer and a sandy subsurface layer that are much thicker than those of the Straber soils.

The major soils are used mainly as improved pasture or rangeland. They were farmed extensively by early settlers. Most of the old fields are now used for improved pasture. The main crops are corn, grain sorghum, and forage sorghum. Careful management is needed to control wind erosion and water erosion. Yields of crops and forage are medium or high, depending on management practices.

The major soils can be used for most kinds of urban and industrial development but have some limitations.

These limitations include a high shrink-swell potential, the slow or very slow permeability, and a corrosive effect on unprotected steel. These limitations can be partly overcome by proper design and installation procedures.

The major soils are suited to most recreational uses; however, careful management is needed to control erosion. The potential for wildlife habitat is good in wooded areas. Deer hunting is common in areas of these soils.

Dominantly Gently Sloping to Strongly Sloping, Loamy and Clayey Soils of the Texas Blackland Prairie

These soils make up about 24 percent of the county. Carbengle, Flatonia, Frelsburg, and Greenvine are the major soils. They formed mainly in calcareous sandstone, marl, and clay and in smaller amounts of tuffaceous material of the Catahoula, Fleming, Oakville Sandstone, and Whitsett Formations. The landscape is rolling and has a well defined drainage pattern.

These soils are used mainly as improved pasture or rangeland. Some areas are used as cropland. Improved pasture grasses include bermudagrass and bluestems. The native range plants are mainly mid and tall prairie grasses interspersed with a few scattered live oak and post oak trees. The main crops are grain sorghum and corn.

Most of these soils are highly erodible. Nitrogen and phosphate fertilizers are needed for good crop yields.

These soils have some limitations as sites for urban and industrial uses. These limitations include depth to sandstone, a high or very high shrink-swell potential, restricted permeability, and a corrosive effect on unprotected steel.

4. Carbengle-Frelsburg

Well drained, moderately permeable and very slowly permeable, loamy and clayey soils; on uplands

These soils are mainly on broad ridges and broad open valleys. Slope ranges from 1 to 8 percent. The Carbengle soils are mainly on ridgetops and side slopes. They are underlain by sandstone. The Frelsburg soils are mainly on side slopes, on broad foot slopes, and in valleys. This unit supports open prairie vegetation. Woody vegetation is sparse and consists mainly of a few large live oak trees. The unit is dissected by many drainageways and creeks, which are tributaries of the Lavaca and Navidad Rivers. About 80 percent of the acreage in this unit has been cleared. Many fields that were once cultivated are now used for improved pasture. Most of the cropland in the county is in this unit in areas of the Frelsburg soils. The main crops are corn and grain sorghum.

This map unit makes up about 23 percent of the county. It is about 38 percent Carbengle soils, 35 percent Frelsburg soils, and 27 percent soils of minor extent (fig. 4).

The Carbengle soils are moderately deep and moderately permeable. Typically, the surface layer is dark grayish brown and is about 13 inches thick. It is loam in the upper part and sandy clay loam in the lower part. The subsoil, from a depth of 13 to 32 inches, is light gray sandy clay loam. The substratum, from a depth of 32 to 80 inches, is very pale brown sandstone that is interbedded with loamy sediments.

The Frelsburg soils are very slowly permeable. Typically, the surface layer is dark gray clay about 8 inches thick. The subsoil is gray clay from a depth of 8 to 52 inches, light brownish gray clay from a depth of 52 to 71 inches, and white clay from a depth of 71 to 80 inches.

Of minor extent in this map unit are Bleiblerville, Branyon, Cuero, Dubina, Latium, Navaca, and Pursley soils. Bleiblerville and Branyon soils are in the lower landscape positions. They have a darker clayey surface layer. Cuero soils are on foot slopes. They have a darker loamy surface layer. Dubina soils are on foot slopes. They have a sandy surface layer. Latium soils are on the eroded slopes of fields and pastures. Navaca and Pursley soils are on flood plains.

The Carbengle soils are used mainly as improved pasture or rangeland. The Frelsburg soils are used mainly as cropland or improved pasture. The main crops are corn and grain sorghum. Careful management is needed to control water erosion. Yields of crops and forage are medium or high, depending on management practices.

The Carbengle soils are suited to most urban and industrial uses. The main limitation is the depth to sandstone. The Frelsburg soils have more limitations, which include a high shrink-swell potential, the very slow permeability, a corrosive effect on unprotected steel, and the clayey texture. These limitations can be partly overcome by proper design and installation of building foundations, pipelines, and septic tank absorption fields.

The major soils are suited to most recreational uses; however, careful management is needed to control water erosion. The Frelsburg soils have large cracks during dry periods and slippery surfaces when the soils are wet. The major soils have fair or good potential for wildlife habitat, especially for dove and quail. Deer hunting is not as common on these soils because of a lack of cover.

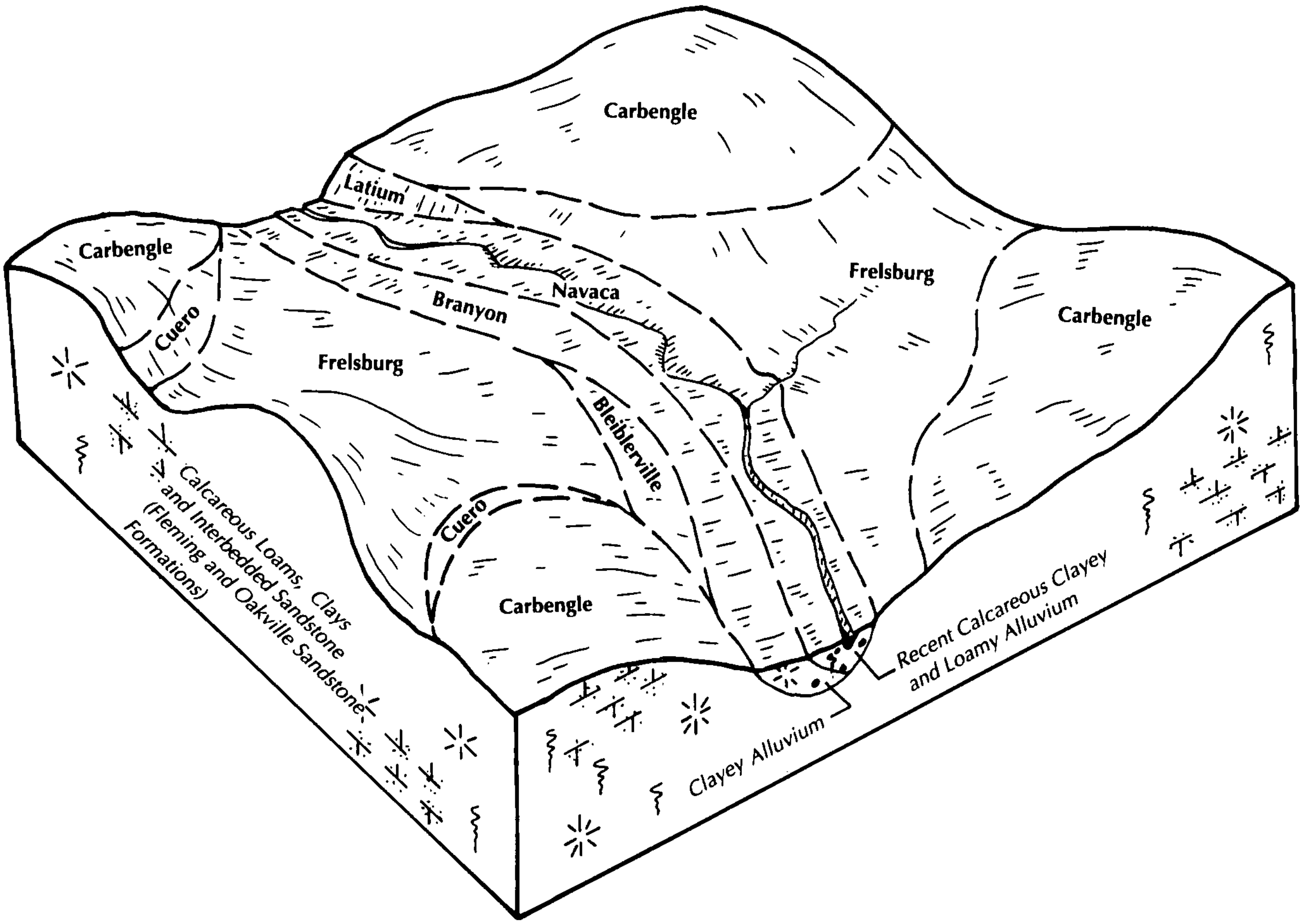

Figure 4.—Typical pattern of soils and parent material in the Carbengle-Frelsburg map unit.

5. Greenvine-Flatonia

Moderately well drained, very slowly permeable and slowly permeable, loamy soils; on uplands

These soils are on broad slopes and ridges. Slope ranges from 1 to 5 percent. Gilgai microrelief is common on the Greenvine soils. This unit supports open prairie vegetation interspersed with a few scattered live oak and post oak trees. Gullies are common in places because of the highly erodible parent material. About 75 percent of the acreage in this unit has been cleared. Many fields that were once cultivated are now used for pasture.

This unit makes up about 1 percent of the county. It is 58 percent Greenvine soils, 19 percent Flatonia soils, and 23 percent soils of minor extent.

The Greenvine soils are moderately deep and very slowly permeable. Typically, the surface layer is about 13 inches thick. It is very dark gray clay loam in the upper part and very dark gray clay in the lower part. The subsoil is dark gray, grayish brown, and light brownish gray clay from a depth of 13 to 35 inches and pale yellow silty clay from a depth of 35 to 48 inches. The substratum, from a depth of 48 to 67 inches, is pale yellow clayey tuff.

The Flatonia soils are deep and slowly permeable. Typically, the surface layer is very dark grayish brown clay loam about 6 inches thick. The subsoil is very dark gray sandy clay from a depth of 6 to 27 inches, dark gray sandy clay from a depth of 27 to 35 inches, gray sandy clay from a depth of 35 to 42 inches, and light gray clay loam from a depth of 42 to 48 inches. The substratum, from a depth of 48 to 80 inches, is stratified, white loamy sediments and very pale brown sandstone.

Of minor extent in this map unit are Carbengle, Falba, and Navaca soils. Carbengle soils are in the more sloping areas of the landscape. They are underlain by sandstone bedrock. Falba soils have a sandy surface layer. They support mostly post oak and

juniper vegetation. Navaca soils are on flood plains. They have a clayey surface layer.

The major soils were farmed extensively by early settlers. Most of the fields are now either idle or used for improved pasture. A few areas are used as cropland. The main crops are corn, grain sorghum, or forage sorghum. Careful management is needed to control water erosion. Yields of crops and forage range from low to high, depending on management practices.

The major soils have several limitations as sites for urban and industrial uses. These limitations include a high shrink-swell potential, the restricted permeability, the clayey texture, and a corrosive effect on unprotected steel. Also, the underlying sandstone and siltstone strata are within 20 inches of the surface in places. These limitations can be partly overcome by proper design and installation procedures.

The major soils are suited to some recreational uses; however, careful management is needed to control water erosion. The main limitations are large cracks during dry periods and slippery surfaces when the soils are wet. The major soils have fair or good potential for wildlife habitat.

Dominantly Nearly Level, Loamy and Sandy Soils of the Gulf Coast Prairies

These soils make up about 15 percent of the county. Cieno, Inez, Morales, and Telferner are the major soils. They formed mainly in clayey and loamy sediments of the Lissie Formation. The landscape is a broad, nearly level plain dotted with small depressions. The drainage pattern is poorly defined.

These soils are used mainly as rangeland, but some areas are used as cropland. The native range plants are mid and tall prairie grasses interspersed with scattered post oak and live oak trees. Crops include irrigated rice and dryland grain sorghum and corn.

Most of these soils are poorly drained or somewhat poorly drained and have a subsoil that restricts the movement of water and the growth of roots. Nitrogen and phosphate fertilizers are needed for good yields.

These soils have some severe limitations as sites for urban and industrial uses. The main limitations are wetness, a moderate or high shrink-swell potential, restricted permeability, and a corrosive effect on unprotected steel.

6. Inez-Morales-Cieno

Somewhat poorly drained and poorly drained, very slowly permeable and slowly permeable, loamy and sandy soils; on uplands

These soils are on broad, nearly level uplands. Slope is 0 to 2 percent. The Morales and Cieno soils are in a broad open savannah. The Inez soils are wooded. The Cieno soils are in open rounded depressions bounded by the partially wooded Morales soils. About 35 percent of the acreage in this unit has been cleared. Most of the cleared areas are used for rice and other crops.

This map unit makes up about 14 percent of the county. It is about 38 percent Inez soils, 30 percent Morales soils, 15 percent Cieno soils, and 17 percent soils of minor extent (fig. 5).

The Inez soils are somewhat poorly drained and very slowly permeable. Typically, the surface layer is light brownish gray loamy fine sand about 10 inches thick. The subsurface layer, from a depth of 10 to 14 inches, is white loamy fine sand. The subsoil is light gray sandy clay mottled in shades of brown, red, or yellow from a depth of 14 to 53 inches and white sandy clay loam that has red mottles from a depth of 53 to 80 inches.

The Morales soils are somewhat poorly drained and slowly permeable. Typically, the surface layer is pale brown fine sandy loam about 4 inches thick. The subsurface layer is very pale brown fine sandy loam from a depth of 4 to 8 inches. The subsoil is light gray sandy clay loam from a depth of 8 to 16 inches, light brownish gray sandy clay from a depth of 16 to 23 inches, light gray sandy clay loam from a depth of 23 to 54 inches, and white sandy clay loam from a depth of 54 to 80 inches.

The Cieno soils are poorly drained and very slowly permeable. Typically, the surface layer is light brownish gray loam about 6 inches thick. The subsoil is light gray sandy clay loam from a depth of 6 to 64 inches and white sandy clay loam from a depth of 64 to 80 inches.

Of minor extent in this map unit are Dacosta, Edna, Fordtran, Kuy, Lake Charles, Milby, Nada, and Pulexas soils. Dacosta, Edna, and Nada soils are in landscape positions similar to those of the Morales and Inez soils. They have a loamy surface layer and support sparse woody vegetation. Fordtran soils are slightly higher on the landscape. They have a thick sandy surface layer and subsurface layer and support prairie vegetation. Kuy and Milby soils are on stream terraces. They have a thick sandy surface layer and subsurface layer. Lake Charles soils are in flat, smooth areas. They have a dark clayey surface layer. Pulexas soils are on flood plains.

Much of this map unit is used as rangeland, but there are several cultivated fields. The main crop is rice, but there are some areas of corn and grain sorghum. Improved pasture grasses are mainly coastal bermudagrass and bahiagrass. Yields of crops and forage are medium or low, depending on management practices.

The major soils have several limitations as sites for urban and recreational uses. These limitations include

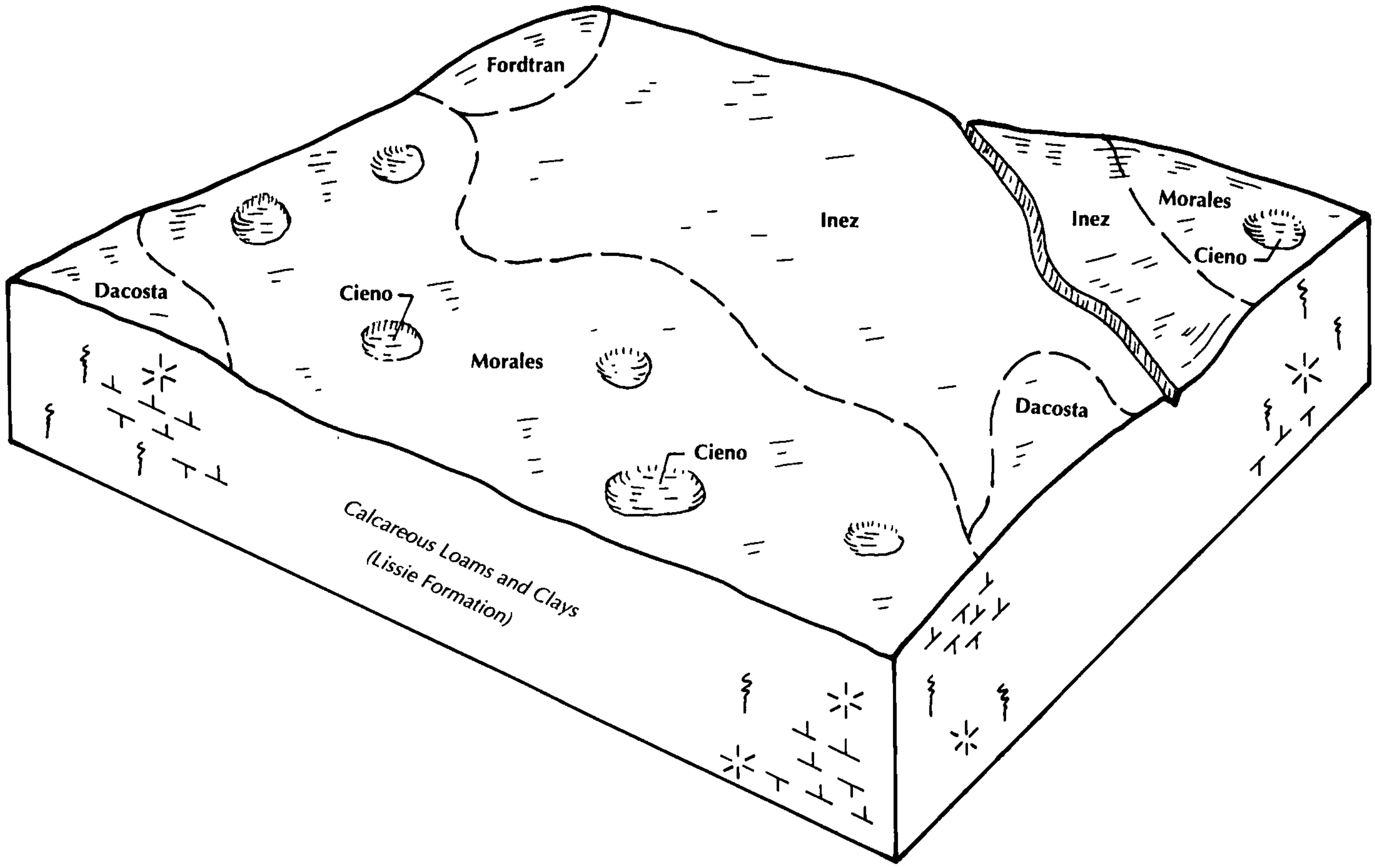

Figure 5.—Typical pattern of soils and parent material in the Inez-Morales-Cieno map unit.

wetness from a perched seasonal high water table, poor drainage, and a corrosive effect on unprotected steel. Also, the Inez soils have a high shrink-swell potential and some areas of the Cieno soils are ponded for long periods. The limitations on the Inez and Morales soils can be partly overcome by proper design and installation procedures.

The major soils provide good wildlife habitat. Deer hunting is common in areas of these soils. Several thousand geese, ducks, and other fowl migrate to this area in the winter.

7. Telferner

Somewhat poorly drained, very slowly permeable, loamy soils; on uplands

These soils are on broad, nearly level uplands. Slope is 0 to 1 percent. The landscape is mostly broad open prairies interspersed with a few live oak trees.

This unit makes up less than 1 percent of the county. It is 80 percent Telferner soils and 20 percent soils of minor extent.

Typically, the Telferner soils have a surface layer of light brownish gray fine sandy loam about 14 inches thick. The subsoil is grayish brown and light brownish gray sandy clay mottled in shades of brown, red, or yellow from a depth of 14 to 46 inches and light gray sandy clay loam from a depth of 46 to 70 inches. The substratum, from a depth of 70 to 80 inches, is white clay loam.

Of minor extent in this map unit are Cieno, Dacosta, Edna, Fordtran, Inez, Morales, and Nada soils. Dacosta, Edna, Fordtran, Inez, and Morales soils are in landscape positions similar to those of the Telferner soils. Dacosta soils have a more clayey surface layer. Edna soils are very poorly drained. Fordtran soils have a thicker, more sandy surface layer. Morales and Inez soils support woody vegetation, including post oak. Cieno and Nada soils are in lower landscape positions than those of the Telferner soils. Cieno soils are ponded for long periods.

Much of this unit is used as rangeland, but some areas are used as cropland or improved pasture. The main crops are rice, corn, and grain sorghum. Yields of

crops and forage are medium or low, depending on management practices.

The major soils have several limitations as sites for urban and recreational uses. These limitations include a high shrink-swell potential and a corrosive effect on unprotected steel. Because of a perched seasonal high water table and poor drainage, excessive wetness is also a limitation. These limitations can be partly overcome by proper design and installation procedures.

The major soils have good potential for wildlife habitat. Deer hunting is common in areas of these soils.

Dominantly Nearly Level to Gently Sloping, Clayey, Loamy, and Sandy Soils on Flood Plains and Terraces

These soils make up about 9 percent of the county. Branyon, Dutek, Kuy, Milby, Navaca, and Navidad are the major soils. They formed mainly in clayey, loamy, and sandy alluvium, some of which has been reworked by the wind. The alluvium is of Recent or of Pleistocene age. The landscape is nearly level to undulating. A meandering river or stream dominates each area.

The major soils are used mainly as rangeland, but a few areas are used as improved pasture or cropland. The native range plants are mid and tall grasses interspersed with live oak, pecan, and post oak trees. Pecan trees are common on the flood plains. The main improved pasture grasses are bermudagrass and bahiagrass. Grain sorghum and corn are the main crops.

Some of these soils are subject to flooding, and some are subject to wind erosion and water erosion. Fertilizer is needed for good yields.

These soils have some limitations as sites for urban and industrial uses. Flooding is a major hazard in the areas on flood plains. The shrink-swell potential is a major limitation in some of the other areas of these soils.

8. Navaca-Branyon-Navidad

Moderately well drained and well drained, very slowly permeable and moderately rapidly permeable, clayey and loamy soils; on bottom land and terraces

These soils are on nearly level flood plains and terraces along the Lavaca and Navidad Rivers and their tributaries. Slopes are mainly less than 1 percent but range to 3 percent. The Navaca soils are in slightly concave areas on flood plains where clayey material has been deposited over loamy and sandy alluvium. The Branyon soils are on nearly level stream terraces that are slightly higher on the landscape than the flood plains. The Navidad soils are on gently undulating, loamy mounds parallel to stream channels on bottom land. The woody vegetation on the Navaca and Navidad soils is dominantly pecan trees.

This map unit makes up about 5 percent of the county. It is about 50 percent Navaca soils, 27 percent Branyon soils, 16 percent Navidad soils, and 7 percent soils of minor extent.

The Navaca soils are moderately well drained and very slowly permeable. Typically, the surface layer is clay about 31 inches thick. The upper part is very dark gray, and the lower part is dark gray. The underlying material is brown fine sandy loam from a depth of 31 to 45 inches and light yellowish brown loamy fine sand from a depth of 45 to 80 inches.

The Branyon soils are moderately well drained and very slowly permeable. Typically, the surface layer is very dark gray clay about 20 inches thick. The subsoil is dark gray clay from a depth of 20 to 45 inches, gray clay from a depth of 45 to 55 inches, and light gray sandy clay loam from a depth of 55 to 80 inches.

The Navidad soils are well drained and moderately rapidly permeable. Typically, the surface layer is dark grayish brown fine sandy loam about 38 inches thick. The underlying material is pale brown sandy loam from a depth of 38 to 55 inches and brown sandy loam from a depth of 55 to 80 inches.

Of minor extent in this map unit are Bleiblerville, Carbengle, Dutek, Frelsburg, Kuy, Milby, and Pursley soils. Bleiblerville and Frelsburg soils are on the slightly higher uplands. They have a clayey surface layer. Carbengle soils are on the nearby uplands. They have a loamy surface layer and are underlain by sandstone. Dutek, Kuy, and Milby soils are on high stream terraces. They have a sandy surface layer. Pursley soils are on flood plains. They have a loamy surface layer.

The Navaca and Navidad soils are used mainly as rangeland because of the hazard of flooding. Some areas are used for pecan orchards, and some are used as improved pasture. The Branyon soils are used mainly as cropland or improved pasture. Yields of crops and forage on this unit are medium or high, depending on management practices.

The Navaca and Navidad soils are limited as sites for most urban and industrial uses because of the hazard of flooding. The Branyon soils are suited to most of these uses but have some limitations. These limitations include a high shrink-swell potential, the very slow permeability, corrosivity, and the clayey texture. The limitations of the Branyon soils can be partly overcome by proper design and installation procedures.

The major soils are suited to some recreational uses, but flooding is a hazard on the Navaca and Navidad soils. The major soils have fair or good potential for wildlife habitat. Deer hunting is common in areas of the Navaca and Navidad soils.

9. Milby-Kuy-Dutek

Moderately well drained and well drained, slowly permeable and moderately permeable, sandy soils; on terraces

These soils are on gently sloping ancient terraces along the Lavaca and Navidad Rivers. Slopes are mainly less than 3 percent but range to 5 percent. The Milby soils are on the higher parts of the landscape. The Kuy and Dutek soils are adjacent to flood plains. This unit is mainly used as rangeland. The woody vegetation is post oak and live oak.

This map unit makes up about 4 percent of the county. It is about 35 percent Milby soils, 34 percent Kuy soils, 19 percent Dutek soils, and 12 percent soils of minor extent.

The Milby soils are moderately well drained and slowly permeable. Typically, the surface layer is pale brown loamy sand about 7 inches thick. The subsurface layer, from a depth of 7 to 29 inches, is very pale brown loamy sand. The subsoil, from a depth of 29 to 66 inches, is light gray sandy clay loam mottled in shades of brown, red, or yellow. The substratum, from a depth of 66 to 80 inches, is reddish yellow sandy clay loam mottled in shades of red or gray.

The Kuy soils are moderately well drained and moderately permeable. Typically, the surface layer is light brownish gray loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 52 inches, is very pale brown loamy fine sand. The subsoil, from a depth of 52 to 80 inches, is light gray sandy clay loam mottled in shades of brown, red, or yellow.

The Dutek soils are well drained and moderately permeable. Typically, the surface layer is pale brown loamy fine sand about 10 inches thick. The subsurface layer, from a depth of 10 to 28 inches, is very pale brown loamy fine sand. The subsoil is red and light red sandy clay loam from a depth of 28 to 52 inches and reddish yellow sandy loam from a depth of 52 to 65 inches. The substratum, from a depth of 65 to 80 inches, is yellow loamy sand.

Of minor extent in this map unit are Inez, Navaca, Navidad, Pulexas, Pursley, Straber, and Tremona soils. Inez, Straber, and Tremona soils are somewhat poorly drained and sandy. They are in the slightly higher landscape positions. Navaca, Navidad, Pulexas, and Pursley soils are loamy and clayey. They are on flood plains.

The major soils are used mainly as rangeland. A few areas are used as improved pasture.

The major soils have some limitations as sites for urban and industrial uses. The limitations of the Milby and Kuy soils include a high shrink-swell potential, corrosivity, and a sandy surface layer. The sandy subsoil is a limitation of the Dutek soils.

The major soils are suited to most recreational uses; however, careful management is needed to control wind erosion and water erosion. Because of the woody vegetation on these soils, the potential for wildlife habitat is good. Deer hunting is common in areas of these soils.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Frelsburg clay, 1 to 3 percent slopes, is a phase of the Frelsburg series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. The Denhawken-Elmendorf complex, 1 to 3 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The gullied land part of the Greenville-Gullied land complex, 3 to 8 percent slopes, is an example. Some miscellaneous areas, such as pits, are too small to be shown and are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Except where otherwise noted, the hazard of wind erosion is slight for each map unit and depth to the water table is more than 6 feet.

Soil Descriptions

BbB—Bleiblerville clay, 1 to 3 percent slopes. This very deep, gently sloping soil is mainly on foot slopes along natural drainageways. Some areas are on ridgetops. The areas on foot slopes are mainly long and narrow and are parallel to the drainageways. The areas on ridgetops are somewhat rounded or oblong. Most areas of this soil are less than 100 acres in size and average about 50 acres.

In undisturbed areas gilgai microrelief consisting of knolls and depressions is more pronounced than on any other soil in the survey area. In cultivated areas this microrelief is barely detectable because plowing has smoothed the surface.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 6 inches; very dark gray, mildly alkaline clay

Subsoil:
6 to 29 inches; very dark gray, mildly alkaline clay
29 to 39 inches; very dark gray, moderately alkaline clay that has light gray mottles
39 to 47 inches; dark gray, moderately alkaline clay that has light gray mottles
47 to 54 inches; gray, mildly alkaline clay that has light gray mottles

Substratum:
54 to 80 inches; white, neutral clay that has yellowish brown mottles

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Medium
Root zone: Deep
Hazard of water erosion: Moderate
Shrink-swell potential: Very high

Included in mapping are small areas of Branyon, Carbengle, and Frelsburg soils. Carbengle and Frelsburg soils are on the higher slightly convex slopes. Branyon soils are in small, narrow bands along streams. Also included are some soils that are similar to the Bleiblerville soil but that are thinner than 60 inches. The included soils make up less than 10 percent of most mapped areas.

The Bleiblerville soil is used mainly as pasture, rangeland, or hayland (fig. 6). Most of the improved pastures were formerly cultivated fields. The improved pasture grasses include bermudagrass, Gordo and other bluestems, and kleingrass.

A few areas are used as cropland. This soil produces good yields of corn, grain sorghum, forage sorghum, and small grain. Leaving crop residue on the surface, growing cover crops, terracing, and contour farming help to control erosion.

This soil has many limitations affecting urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, corrosivity, and the clayey texture. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil supports native vegetation typical of a tall grass prairie. It provides good habitat for dove and quail.

The capability subclass is IIe; Blackland (Blackland Prairie) range site.

BrA—Branyon clay, 0 to 1 percent slopes. This very deep, nearly level soil is on broad, ancient stream terraces. It is mainly along the Lavaca River, but smaller areas are along the Navidad River and along the major creeks in the county. The areas are mostly broad plains between lower flood plains and higher uplands. They range from 20 to more than 300 acres in size.

In undisturbed areas gilgai microrelief consisting of small knolls and rounded depressions is common. In cultivated fields this microrelief is barely detectable because plowing has smoothed the surface.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 6 inches; very dark gray, neutral clay
6 to 20 inches; very dark gray, mildly alkaline clay

Subsoil:
20 to 45 inches; dark gray, mildly alkaline clay
45 to 55 inches; gray, moderately alkaline clay
55 to 80 inches; light gray, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Slow
Root zone: Deep, but the clayey texture restricts root penetration
Hazard of water erosion: Slight
Shrink-swell potential: Very high

Figure 6.—Coastal bermudagrass in an area of Bleiblerville clay, 1 to 3 percent slopes.

Included in mapping are small areas of Bleiblerville, Carbengle, Frelsburg, Navaca, and Pursley soils. Bleiblerville, Carbengle, and Frelsburg soils are on the higher slightly convex slopes. Navaca and Pursley soils are on the small lower flood plains. Also included are soils that are similar to the Branyon soil but have a surface layer of clay loam about 12 inches thick and some areas of soils that are noncalcareous to a depth of 24 inches. The included soils make up less than 10 percent of the map unit.

The Branyon soil is used mainly as cropland or improved pasture. A few small areas are used as rangeland.

Corn and grain sorghum are the main crops. Some areas are planted to forage sorghum or small grain. Improvement of tilth and internal drainage are the main concerns in managing this soil for crops. Good management practices include leaving crop residue on the surface, growing cover crops, and applying fertilizer to increase yields.

Improved pasture grasses include coastal bermudagrass, Gordo bluestem and other bluestems, and kleingrass. Applications of fertilizer are needed to maintain high forage yields.

On rangeland, native grasses, such as bluestems, indiangrass, panicums, and paspalums, produce high forage yields.

This soil has many limitations affecting urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, corrosivity, and the clayey texture. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road

subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has fair potential for openland and rangeland wildlife habitat. The wildlife consists mainly of dove, quail, rabbits, and songbirds. Deer are common on nearby wooded bottom land. They graze in areas of this soil at night. Some migratory birds feed on the grain lost during harvesting.

The capability subclass is IIw; Blackland (Blackland Prairie) range site.

CaB—Carbengle loam, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on low ridges and side slopes in the uplands. It is commonly along drainageways in the western part of the county. Individual areas are long and narrow. They range from 20 to about 100 acres in size and average about 40 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 14 inches; dark gray, moderately alkaline loam

Subsoil:
14 to 36 inches; grayish brown, moderately alkaline sandy clay loam

Substratum:
36 to 80 inches; very pale brown, moderately alkaline, interbedded sandstone and loamy sediments

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Moderate
Surface runoff: Slow or medium
Root zone: Moderately deep
Hazard of water erosion: Moderate
Shrink-swell potential: Low

Included in mapping are small areas of Bleiblerville, Cuero, and Frelsburg soils. Most of these soils are on the lower slopes. Also included is a soil that is similar to the Carbengle soil but has a subsoil with more than 35 percent clay, small areas of sandstone rock outcrop on the upper slopes, and some small areas where the depth to sandstone is 40 to 60 inches. The included areas make up less than 15 percent of the map unit.

The Carbengle soil is used mainly as rangeland. Some areas are used as improved pasture, and others are used as cropland. Rangeland vegetation includes live oak trees and bluestems and other grasses. The rangeland produces medium forage yields.

Improved pasture grasses include coastal bermudagrass, kleingrass, and bluestems, such as Gordo bluestem.

The main crops are grain sorghum, corn, and small grain. Some areas are planted to forage sorghum. Yields are medium. Applications of fertilizer, especially nitrogen, increase crop yields. Terraces, contour farming, grassed waterways, and crop residue management help to control erosion and maintain the productivity of the soil.

This soil is suitable for most urban and recreational uses. The main limitation is the depth to sandstone. Sewage effluent can move through the fractured sandstone and contaminate underground water supplies. Some garden and landscape plants and trees are affected by chlorosis because of a high content of lime. The most reliable native shade tree is live oak.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The number of deer is limited in all areas, except for those adjacent to wooded areas. The main kinds of wildlife are coyote, dove, quail, and rabbits.

The capability subclass is IIe; Clay Loam range site.

CaC—Carbengle loam, 3 to 5 percent slopes. This moderately deep, gently sloping soil is on high, broad ridges and upper side slopes in the uplands. These ridges dominate the landscape in the western part of the county. Individual areas are broad and irregular in shape. They range from 20 to about 1,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 5 inches; dark grayish brown, moderately alkaline loam
5 to 13 inches; dark grayish brown, moderately alkaline sandy clay loam

Subsoil:
13 to 32 inches; light gray, moderately alkaline sandy clay loam

Substratum:
32 to 80 inches; very pale brown, moderately alkaline, interbedded sandstone and loamy sediments

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Moderate
Surface runoff: Medium
Root zone: Moderately deep
Hazard of water erosion: Severe
Shrink-swell potential: Low

Included in mapping are small areas of Cuero, Denhawken, Elmendorf, Frelsburg, and Latium soils. Most of these soils are on the lower slopes, but small areas are on the nearly level ridgetops. Included along ridgetops are small areas of sandstone rock outcrop. Also included on the lower slopes are soils that are similar to the Carbengle soil but that are 40 to 60 inches deep to sandstone. The included areas make up less than 15 percent of the map unit.

The Carbengle soil is used mainly as rangeland. Some areas are used as improved pasture, and others are used as cropland. The rangeland produces medium forage yields. Rangeland vegetation includes live oak trees and bluestems and other grasses.

Improved pasture grasses include coastal bermudagrass, kleingrass, and bluestems, such as Gordo bluestem.

The main crops are grain sorghum, corn, and small grain. Some areas are planted to forage sorghum. Yields are medium. Applications of fertilizer, especially nitrogen, increase crop yields. Terraces, contour farming, grassed waterways, and crop residue management help to control erosion and maintain the productivity of the soil.

This soil is suitable for most urban and recreational uses. The main limitations are the depth to sandstone and the slope. Sewage effluent can move through the fractured sandstone and contaminate underground water supplies. Some garden and landscape plants and trees are affected by chlorosis because of a high content of lime. The most reliable native shade tree is live oak.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The number of deer is limited in all areas, except for those adjacent to wooded areas. The main kinds of wildlife are coyote, dove, quail, and rabbits.

The capability subclass is IIIe; Clay Loam range site.

CaC3—Carbengle loam, 2 to 5 percent slopes, eroded. This moderately deep, gently sloping, eroded soil is on the sides of ridges in the uplands. Some of the areas are fields that were once cultivated. The fields were not terraced, or the terraces were not maintained. Several areas are near creeks and other drainageways. Individual areas are irregular in shape and range from 20 to about 100 acres in size.

Sheet erosion is extensive on this soil. On the upper 200 to 300 feet of the slope, it has removed about one-half of the original surface layer. Most areas have gullies that are V-shaped and are 2 to 5 feet deep. In some areas the gullies are as close as 500 feet apart, with a few more closely spaced. In places the lighter colored subsoil is exposed. To control further erosion, gullies should be reshaped and ground cover established.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 8 inches; grayish brown, moderately alkaline loam

Subsoil:
8 to 24 inches; light brown to pink, moderately alkaline clay loam

Substratum:
24 to 80 inches; pale brown, moderately alkaline, interbedded sandstone and loamy sediments

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Moderate
Surface runoff: Rapid
Root zone: Moderately deep
Hazard of water erosion: Severe
Shrink-swell potential: Low

Included in mapping are small areas of Cuero, Frelsburg, and Latium soils. Also included are soils that are similar to the Carbengle soil but have sandstone at a depth of 40 to 60 inches. Included soils are mainly on the lower slopes. Some small convex mounds and ridgetops have exposed sandstone rock outcrop. The included areas make up less than 20 percent of the map unit.

The Carbengle soil is used mainly as rangeland. Forage yields are medium. In some areas gullies have

been mechanically shaped and planted to improved pasture grasses.

In some areas this soil is limited as a site for some urban and recreational uses. The depth to sandstone is the main limitation. Gullies need to be reshaped and vegetated to prevent further erosion. Some areas are used for sanitary landfills. Topsoil should be stockpiled for later use as a final cover for the landfill. Additional topsoil is usually needed from other areas.

This soil provides fair habitat for coyote, dove, quail, and rabbits.

The capability subclass is IVe; Clay Loam range site.

CaD—Carbengle loam, 5 to 8 percent slopes. This moderately deep, strongly sloping soil is on high ridges and the upper side slopes in the uplands. It is dominantly on high slopes along the Lavaca River. Individual areas are long and narrow and are parallel to streams. They range from 20 to about 200 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 10 inches; dark gray, moderately alkaline loam

Subsoil:
10 to 30 inches; brown, moderately alkaline sandy clay loam

Substratum:
30 to 80 inches; interbedded sandstone and loamy sediments (fig. 7)

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Moderate
Surface runoff: Rapid
Root zone: Moderately deep
Hazard of water erosion: Severe
Shrink-swell potential: Low

Included in mapping are small areas of Cuero, Frelsburg, and Latium soils. Most of these soils are on the lower slopes, but some Frelsburg and Cuero soils are on the nearly level ridgetops. Also included are a few areas of sandstone rock outcrop. The included areas make up less than 15 percent of the map unit.

The Carbengle soil is used mainly as rangeland. A few areas are used as improved pasture. The rangeland produces medium forage yields. Rangeland vegetation includes live oak trees and bluestems and other grasses.

Improved pasture grasses include coastal bermudagrass, kleingrass, and bluestems, such as Gordo bluestem.

This soil is suitable for some types of urban uses. Careful management is needed to prevent excessive erosion. Areas of this soil provide good sites for homes because the high slopes provide an esthetic view. The main limitations are the slope and the depth to sandstone. The rock outcrop is a limitation in some areas. Sewage effluent can contaminate underground water supplies. Some yard and garden plants, shrubs, and trees are affected by chlorosis because of a high content of lime. Live oak is the dominant native shade tree.

The slope and the depth to bedrock severely limit some recreational uses. Some areas may be too sloping for use as playing fields or playgrounds. A vegetative cover or pavement should be used to prevent excessive water erosion.

This soil has fair potential for rangeland wildlife habitat. The main kinds of wildlife are dove and quail.

The capability subclass is IVe; Clay Loam range site.

CtC—Catilla loamy sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on foot slopes, low ridges, and upland stream divides. Slopes are mostly convex and in places are gently undulating. This soil occurs mostly in the southwestern part of the county near streams, such as Brushy and Clarks Creeks. Individual areas are elongated or somewhat rounded. They range from 30 to 300 acres in size and average about 150 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 10 inches; pale brown, slightly acid loamy sand

Subsurface layer:
10 to 49 inches; very pale brown, slightly acid loamy sand

Subsoil:
49 to 60 inches; light gray, medium acid sandy clay loam
60 to 80 inches; very pale brown, medium acid or slightly acid sandy clay loam

Important soil properties—

Drainage class: Moderately well drained
Permeability: Moderately slow
Available water capacity: Low
Surface runoff: Very slow
Root zone: Deep
Hazard of wind erosion: Severe
Hazard of water erosion: Slight

Figure 7.—Sandstone bedrock exposed along a pit wall in an area of Carbengle loam, 5 to 8 percent slopes.

Water table: Perched at a depth of 3 to 5 feet following rainy periods, generally in winter and spring
Shrink-swell potential: Very low

Included with this soil in mapping are small areas of Dubina, Straber, and Tremona soils. These included soils are in landscape positions similar to those of the Catilla soil. Also included are Navidad and Pursley soils on narrow flood plains, a few areas of soils that are similar to the Catilla soil but have more than 35 percent clay in the subsoil, and small areas of soils that have a neutral or moderately alkaline surface layer. The included soils make up less than 15 percent of a map unit.

The Catilla soil is used as rangeland or pasture.

Improved pasture grasses include coastal bermudagrass and bahiagrass. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum pasture and hay production.

Rangeland overstory vegetation consists mainly of thick stands of live oak, post oak, and invading yaupon. The amount of bluestems, paspalums, panicums, and other grasses varies, depending on management practices.

This soil is limited as a site for most urban and recreational uses. The thick sandy surface layer, seepage, and the perched seasonal high water table are the main limitations. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. The sandy texture of this soil provides a poor filter for septic tank absorption fields. This soil does not provide an ideal surface for camp areas or for other recreational uses. Soil blowing can be a nuisance in recreational areas where the surface is not adequately protected. A vegetative cover can reduce the hazards of wind erosion and water erosion.

The dense woody vegetation provides good habitat for deer, dove, quail, and squirrels. Deer hunting is common in areas of this soil.

The capability subclass is IIIe; Deep Sand Savannah range site.

CuB—Cuero sandy clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on foot slopes below sandstone ridges. Slopes are mostly plane or convex but some are slightly concave. The areas are elongated or somewhat rounded and are parallel to the ridges. They range from 20 to 100 acres in size and average about 30 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 8 inches; very dark grayish brown, neutral sandy clay loam

Subsoil:

8 to 22 inches; dark grayish brown, neutral sandy clay loam

22 to 36 inches; reddish brown, moderately alkaline clay loam

36 to 48 inches; brown, moderately alkaline sandy clay loam

Substratum:

48 to 52 inches; pale brown, moderately alkaline, interbedded, weakly cemented sandstone and sandy clay loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Moderate
Surface runoff: Slow or medium
Root zone: Deep
Hazard of water erosion: Moderate
Shrink-swell potential: Moderate

Included in mapping are small areas of Carbengle, Frelsburg, and Hallettsville soils. Carbengle soils are mainly in the higher landscape positions. Frelsburg and Hallettsville soils are in the lower landscape positions. Also included are areas of soils that are similar to the Cuero soil but are dark to a depth of less than 20 inches, a few soils that have mottles in the subsoil, and other soils that have cemented sandstone within a depth of 30 inches. Some soils have loamy fine sand below a depth of 50 inches, and other soils have slopes of as much as 5 percent. The included soils make up less than 20 percent of the map unit.

The Cuero soil is used as rangeland, cropland, or pasture. On rangeland, grasses, such as bluestems, gramas, indiangrass, and paspalums, produce high forage yields if properly managed.

Corn and grain sorghum are the main crops. Some areas are planted to forage sorghum or small grain. Leaving crop residue on the surface and growing cover crops help to control erosion and maintain the productivity and tilth of the soil. Contour farming, terraces, and grassed waterways also help to control erosion. Applications of fertilizer, including nitrogen, phosphates, and potash, increase crop yields.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses, bluestems, and kleingrass. Applications of fertilizer and rotation grazing are needed for maximum pasture and hay production.

This soil is suitable for most urban and recreational uses. It has only moderate limitations, which include the moderate shrink-swell potential and corrosivity. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Pipelines, storage tanks,

and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. In places the slope is a moderate limitation affecting the use of this soil as a site for playgrounds.

This soil has a few live oak trees, but the vegetation consists mainly of open prairie plants. It has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. Dove, quail, rabbits, and some deer from wooded areas are present in areas of this soil.

The capability subclass is IIe; Clay Loam range site.

DaA—Dacosta sandy clay loam, 0 to 1 percent slopes. This very deep soil is on nearly level or slightly concave uplands and ancient stream terraces. It occurs only in the southern part of the county. Individual areas are oval or elongated and are sometimes parallel to major streams. They range from 20 to 200 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 6 inches; grayish brown, neutral sandy clay loam

6 to 18 inches; dark gray, neutral clay loam

Subsoil:

18 to 26 inches; dark gray, neutral clay

26 to 36 inches; gray, neutral clay loam

36 to 62 inches; light gray, mildly alkaline or moderately alkaline clay loam

Substratum:

62 to 80 inches; white, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Very slow
Root zone: Deep
Hazard of water erosion: Slight
Water table: Apparent within a depth of 2 feet during rainy periods
Shrink-swell potential: High

Included in mapping are small areas of Cieno, Edna, Inez, Lake Charles, and Telferner soils. Cieno soils are in small rounded depressions. All of the other included soils are in landscape positions slightly higher than or similar to those of the Dacosta soil. Also included are a few soils that are similar to the Dacosta soil but are thinner than 40 inches and soils that are similar to the Dacosta soil but have loamy fine sand below a depth of 60 inches. The included soils make up less than 15 percent of the map unit.

The Dacosta soil is used mainly as rangeland. A few areas are used as cropland or improved pasture.

Rangeland vegetation consists of open prairie plants, including bluestems, paspalums, and panicums interspersed with a few live oak trees. Forage yields are medium or high, depending on management practices. Good management practices include deferred grazing, especially during dry periods.

The areas used for cropland are mainly along the Jackson County line. The main crops are corn and grain sorghum. Maintaining favorable soil structure and tilth is difficult, and a surface crust and plowpan are common. Runoff is very slow in nearly level fields, resulting in excess surface water at times. Good management practices include leaving crop residue on the surface, applying a system of timely and limited tillage, and rotating crops. Fertilizer is needed for maximum crop production and should be applied based on laboratory test results. Drainage ditches are beneficial when adequate outlets are available.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo or other bluestems are planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum hay and pasture production.

This soil has many limitations affecting urban and recreational uses. The main limitations are the seasonal high water table, inadequate drainage, the very slow permeability, the clayey texture, corrosivity, and the shrink-swell potential. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil provides good habitat for dove, ducks, geese, and quail. Several thousand geese and other fowl migrate to this area in the winter. The Attwater prairie chicken nests in a few well managed areas.

Mottled ducks make limited use of the habitat for nests, cover, and food. Deer from nearby wooded areas often browse in areas of this soil.

The capability subclass is IIIw; Blackland (Coast Prairie) range site.

DeB—Denhawken-Elmendorf complex, 1 to 3 percent slopes. These soils are on the upper parts of broad, gently sloping ridges. They are mainly in the southwestern and central parts of the county. Individual areas range from 20 to about 600 acres in size and average about 200 acres.

The Denhawken soil makes up about 53 percent of the total acreage and 50 to 60 percent of individual areas. The Elmendorf soil makes up about 45 percent of the total acreage and 40 to 50 percent of individual areas. In undisturbed areas the microrelief consists of small ridges and valleys in a repeating pattern of parallel or linear bands up and down the slopes. The Denhawken soil is on the ridges. It is 5 to 12 inches higher than the Elmendorf soil, which is in the valleys. The ridges average 10 to 20 feet across, and the valleys average about 10 feet across. Both extend several hundred feet in length. These soils occur as areas so intricately mixed that mapping them separately is not practical at the selected scale.

In nearly all areas, these soils have a distinct vegetative pattern. Short grasses are extensive on the ridges, and tall broomweed plants are common in the valleys. On aerial photographs this unit has a tonal pattern of elongated dark and light strips. Locally, these are referred to as a "tiger stripe" pattern.

The typical sequence, depth, and composition of the layers of the Denhawken soil are—

Surface layer:
0 to 6 inches; grayish brown, moderately alkaline clay loam

Subsoil:
6 to 22 inches; light brownish gray, moderately alkaline clay loam
22 to 43 inches; very pale brown, moderately alkaline clay

Substratum:
43 to 70 inches; very pale brown, moderately alkaline clay
70 to 80 inches; pink, moderately alkaline clay

The typical sequence, depth, and composition of the layers of the Elmendorf soil are—

Surface layer:
0 to 12 inches; very dark gray, neutral sandy clay loam

Subsoil:
12 to 25 inches; very dark gray, neutral clay loam
25 to 42 inches; dark gray, neutral clay
42 to 54 inches; dark gray, moderately alkaline clay
54 to 80 inches; gray, moderately alkaline clay

Important soil properties of the Denhawken and Elmendorf soils—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Medium
Root zone: Deep
Hazard of water erosion: Moderate
Shrink-swell potential: High

Included in mapping are small areas of Cuero, Carbengle, Hallettsville, Dubina, Straber, and Tremona soils. Cuero and Carbengle soils are on small sandstone ridges. Hallettsville and Dubina soils are on gently sloping to slightly concave foot slopes. Straber and Tremona soils are mainly on sandy, wooded foot slopes, but some areas of these soils are on small sandy ridgetops. Also included are small gullies as much as 6 feet deep and small areas where the slope is as much as 5 percent. The included soils make up less than 20 percent of the map unit.

The Denhawken and Elmendorf soils are used as cropland, rangeland, or pasture. The main crops are corn and grain sorghum. Maintaining favorable soil structure and tilth is difficult. Good management practices include leaving crop residue on the surface, applying a system of timely and limited tillage, terracing, and rotating crops. Incorporating crop residue into the soils helps to maintain favorable soil structure and tilth and increases the rate of water intake. Fertilizer is needed for maximum crop production. These soils are well suited to improved pasture of Gordo bluestem and kleingrass. Rangeland vegetation includes scattered live oak and post oak trees and bluestems, paspalums, and panicums.

These soils have many limitations as sites for most urban and recreational uses. The main limitations are the shrink-swell potential, corrosivity, and the very slow permeability. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption

Figure 8.—A farm pond in an area of the Denhawken-Elmendorf complex, 1 to 3 percent slopes, used as a watering place by wildlife as well as by livestock.

fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the high corrosion potential of the soils.

These soils support open prairie vegetation and a few trees. They provide good habitat for dove and quail (fig. 8). Some deer from nearby wooded areas browse on these soils.

The capability subclass is IIIe; Rolling Blackland range site.

DhA—Dietrich fine sandy loam, 0 to 1 percent slopes. This very deep, saline, nearly level soil is on ancient stream terraces. It is minor in extent and occurs only in the southern part of the county. Individual areas are parallel to streams and are somewhat elongated.

They range from 10 to 100 acres in size and average about 20 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
- 0 to 3 inches; light gray, slightly acid fine sandy loam
- 3 to 12 inches; grayish brown, neutral fine sandy loam

Subsoil:
- 12 to 32 inches; gray, mildly alkaline, saline sandy clay loam
- 32 to 52 inches; grayish brown, moderately alkaline, saline clay loam
- 52 to 72 inches; white, moderately alkaline, saline sandy clay loam

Substratum:
- 72 to 80 inches; white, moderately alkaline, saline fine sandy loam

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Slow
Available water capacity: Low because of a high content of sodium
Surface runoff: Slow or very slow
Root zone: Deep
Hazard of water erosion: Slight
Water table: Perched within a depth of 2 feet during rainy periods
Shrink-swell potential: Moderate

Included in mapping are small areas of Dacosta, Edna, Kuy, Navidad, and Pursley soils. Dacosta and Edna soils are in landscape positions similar to those of the Dietrich soil. Kuy and Navidad soils are gently sloping. They are adjacent to flood plains. Pursley soils are in concave areas adjacent to streams. Navidad and Pursley soils are subject to flooding. The included soils make up less than 15 percent of the map unit.

The Dietrich soil is used mainly for rangeland or wildlife habitat. Vegetation is sparse because of excessive amounts of sodium. Rangeland vegetation includes scattered mesquite, huisache, running live oak, pricklypear, small live oak, and salt grasses. This soil has limited potential for grazing by livestock.

This soil is limited as a site for most urban and recreational uses. The slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil.

The woody vegetation provides limited wildlife habitat. Deer browse in areas of this soil. Dove, quail, and squirrels also inhabit these areas.

The capability subclass is IVs; Salty Prairie range site.

DnB—Dubina loamy fine sand, 1 to 3 percent slopes. This very deep, gently sloping soil is on foot slopes, low ridges, and upland stream divides. Slopes are mostly convex, but some areas are plane or slightly concave. Individual areas are oval or irregular in shape. They range from 20 to more than 200 acres in size and average about 100 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
- 0 to 11 inches; dark grayish brown, medium acid loamy fine sand

Subsoil:
- 11 to 17 inches; dark grayish brown, slightly acid sandy clay
- 17 to 33 inches; brown, medium acid sandy clay
- 33 to 43 inches; light brownish gray, medium acid sandy clay loam
- 43 to 61 inches; strong brown, slightly acid sandy clay loam
- 61 to 69 inches; brown, neutral sandy loam

Substratum:
- 69 to 80 inches; white, moderately alkaline loamy sand

Important soil properties—

Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Slow or medium
Root zone: Deep
Hazard of wind erosion: Moderate
Hazard of water erosion: Moderate
Water table: Perched within a depth of 1 to 2 feet during rainy periods
Shrink-swell potential: High in the upper part of the subsoil and moderate in the lower part

Included with this soil in mapping are small areas of Carbengle, Cuero, Denhawken, Elmendorf, Hallettsville,

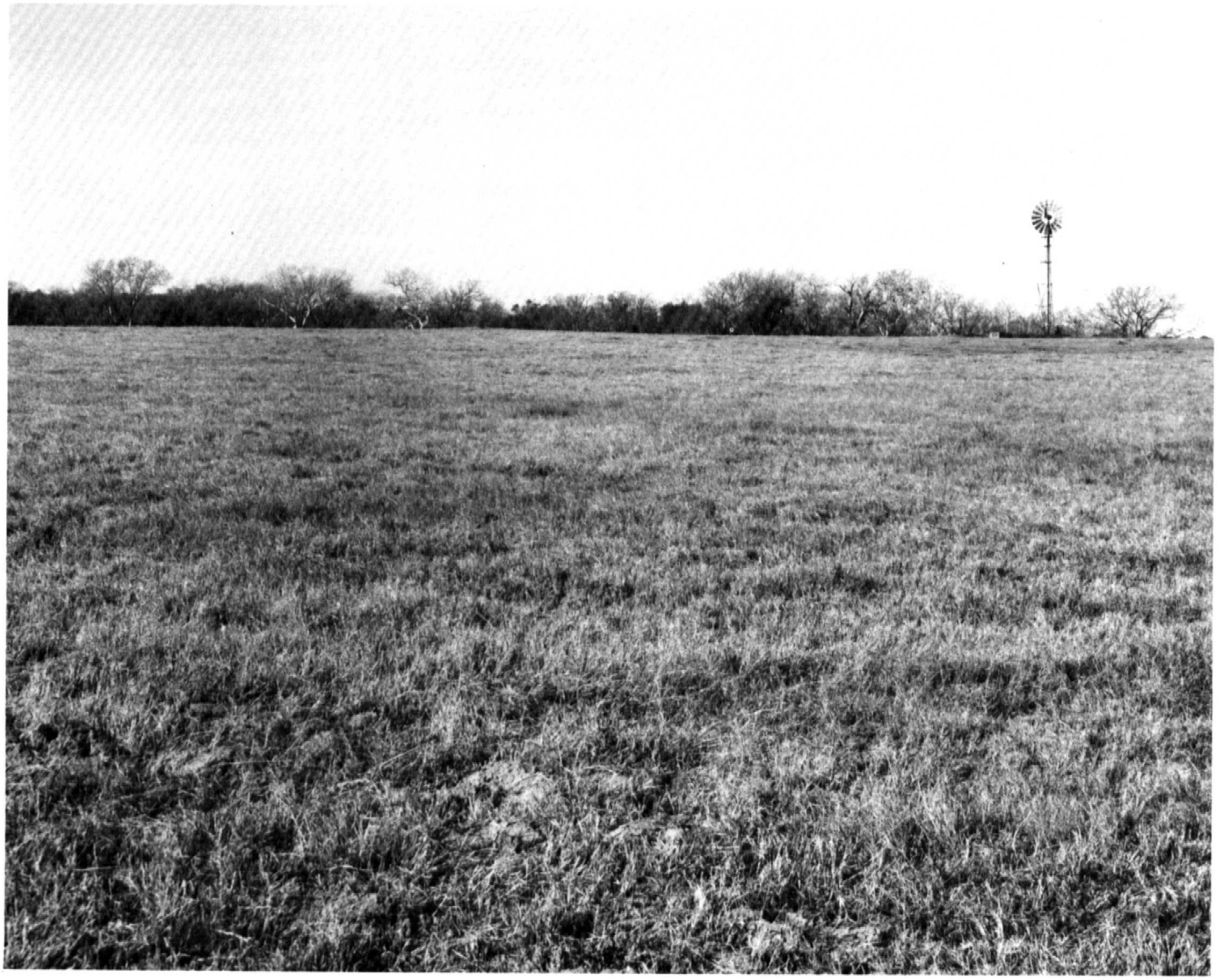

Figure 9.—A coastal bermudagrass pasture in an area of Dubina loamy fine sand, 1 to 3 percent slopes.

Straber, and Tremona soils. Carbengle and Cuero soils are on small, convex slopes. They are underlain by sandstone. Denhawken and Elmendorf soils are mapped in a complex on small clayey ridges. Hallettsville soils are in slightly concave depressions on the slightly lower parts of the landscape. Straber and Tremona soils are on sandy, convex slopes that have thick stands of post oak trees. Most of the included soils are in landscape positions that are higher than those of the Dubina soil, except some areas of the Straber and Tremona soils. The included soils make up less than 20 percent of the map unit.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses (fig. 9). Bahiagrass is planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum pasture and hay production.

The rangeland vegetation includes bluestems, paspalums, and panicums; scattered live oak; and a few post oak trees. The rangeland produces medium or high yields if good management practices, such as deferred grazing, are applied.

The areas used as cropland are limited in extent. The main crops are corn and grain sorghum. Some areas are planted to either forage sorghum or small grain. This soil has good tilth and can be worked throughout a wide range of moisture conditions. Good management practices include leaving crop residue on the surface,

growing cover crops, farming on the contour, terracing, and establishing grassed waterways. These practices help to maintain the productivity and tilth and to control wind erosion and water erosion. Applications of fertilizer, including nitrogen, phosphate, and potash, increase crop yields and should be applied based on laboratory test results.

This soil has some limitations affecting urban and recreational uses. The slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Recreational areas need a good vegetative cover to reduce the hazards of wind erosion and water erosion.

This soil produces good stands of live oak trees and grasses. This vegetation, along with trees on adjacent soils, provides good habitat for deer, dove, quail, songbirds, and squirrels.

The capability subclass is IIIe; Sandy Loam range site.

DuC—Dutek loamy fine sand, 1 to 5 percent slopes. This gently sloping, very deep soil is on ancient terraces adjacent to the flood plains along rivers and large creeks. Slopes are convex. Individual areas are long and narrow and are parallel to stream channels. They range from 20 to more than 200 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 10 inches; pale brown, slightly acid loamy fine sand

Subsurface layer:

10 to 28 inches; very pale brown, slightly acid loamy fine sand

Subsoil:

28 to 38 inches; red, strongly acid sandy clay loam

38 to 52 inches; light red, very strongly acid sandy clay loam

52 to 65 inches; reddish yellow, very strongly acid sandy loam

Substratum:

65 to 80 inches; yellow, slightly acid loamy sand

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: Low
Surface runoff: Very slow or slow
Root zone: Deep
Hazard of wind erosion: Moderate
Hazard of water erosion: Moderate
Shrink-swell potential: Low

Included with this soil in mapping are small areas of Catilla, Kuy, Milby, Navidad, and Tremona soils. Navidad soils are on the lower, slightly undulating flood plains. Milby and Tremona soils are mostly in the higher areas. Catilla and Kuy soils have a thicker surface layer than that of the Dutek soil. They are on foot slopes. Also included are some small areas of soils that are similar to the Dutek soils but have a surface layer less than 20 inches thick and areas of soil that are loamy sand. The included soils make up about 10 percent of the map unit.

The Dutek soil is used mainly as rangeland or wildlife habitat. Forage yields are low or medium, depending on management practices. The rangeland vegetation includes post oak and live oak trees and bluestems and other grasses.

This soil has limitations affecting tillage because of the thick sandy surface layer. Crop residue should be kept on the surface to reduce the hazard of erosion. This soil is not suitable as a site for farm ponds because of the rapidly permeable underlying material.

This soil has limitations affecting some urban and recreational uses. The slope, seepage, and the sandy surface layer are the main limitations. A vegetative cover should be used to prevent wind erosion and water erosion on construction sites and recreational areas. The soil does not provide an ideal surface for camp areas or for other recreational uses. Soil blowing can be a nuisance in areas where the surface is not adequately protected by vegetation or other ground cover.

This soil produces thick stands of post oak and live oak trees. Invading yaupon is common. This dense woody vegetation provides good habitat for deer, dove, and quail.

The capability subclass is IIIe; Sandy range site.

EdA—Edna fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil is on uplands. It is minor in extent and occurs only in the extreme southeastern part of the county. Individual areas are oval or irregular in shape. They range from 20 to 100 acres in size and average about 30 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 6 inches; light gray, medium acid fine sandy loam

Subsurface layer:

6 to 8 inches; white, medium acid fine sandy loam

Subsoil:

8 to 29 inches; grayish brown clay that is medium acid in the upper part and mildly alkaline in the lower part

29 to 62 inches; light gray and light brownish gray, moderately alkaline sandy clay

Substratum:

62 to 80 inches; white, moderately alkaline sandy clay loam

Important soil properties—

Drainage class: Poorly drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Very slow
Root zone: Deep
Hazard of water erosion: Slight
Water table: Perched within a depth of 1.5 feet during rainy periods
Shrink-swell potential: High

Included in mapping are small areas of Cieno, Dacosta, Lake Charles, Morales, Nada, and Telferner soils. Cieno soils are in small rounded depressions. All of the other included soils are in landscape positions that are slightly higher or similar to those of the Edna soil. The included soils make up less than 15 percent of the map unit.

The Edna soil is used mainly as rangeland. A few areas are used as cropland or improved pasture.

The rangeland vegetation consists of open prairie plants, including paspalums and panicums and a few running live oak. Forage yields are medium.

This soil is moderately suited to cropland. The main crops are rice, corn, and grain sorghum. The low natural fertility level and the droughtiness limit production. Runoff is very slow in large, nearly level areas. The very slow runoff results in excess surface water. Good management practices include leaving crop residue on the surface, applying a system of timely and limited tillage, and rotating crops. Fertilizer is needed for maximum crop production. Drainage ditches are beneficial where adequate outlets are available.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Gordo bluestem is planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum hay and pasture production.

This soil has many limitations affecting urban and recreational uses. The main limitations are the perched seasonal high water table, inadequate drainage, the very slow permeability, the clayey texture, corrosivity, and the shrink-swell potential. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil provides good habitat for dove, ducks, geese, and quail. Several thousand geese, ducks, and other fowl migrate to this area in the winter. The Attwater prairie chicken nests in a few well managed areas. Mottled ducks make limited use of the habitat for nests, cover, and food. Deer from nearby wooded areas browse in areas of this soil.

The capability subclass is IIIw; Claypan Prairie range site.

FbB—Falba loamy fine sand, 1 to 3 percent slopes. This moderately deep and deep, gently sloping soil is on low ridges and foot slopes. It is minor in extent and occurs only in the extreme northwestern part of the county along the Gonzales County line. Areas of this soil are adjacent to the slightly higher Greenvine and Flatonia soils. They have a distinct cedar and post oak tree vegetation that contrasts with the nearby prairie vegetation. Individual areas are irregular in shape and are often parallel to the slopes. They range from 20 to 150 acres in size and average about 80 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 6 inches; brown, neutral loamy fine sand

Subsurface layer:
6 to 12 inches; light brownish gray, medium acid loamy fine sand

Subsoil:
12 to 26 inches; grayish brown, very strongly acid sandy clay
26 to 43 inches; light brownish gray, strongly acid sandy clay
43 to 49 inches; very pale brown, moderately alkaline sandy clay loam

Substratum:
49 to 80 inches; very pale brown, moderately alkaline, weakly cemented sandstone

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: Moderate
Surface runoff: Slow or medium
Root zone: Deep, but the clayey subsoil restricts root penetration
Hazard of wind erosion: Moderate
Hazard of water erosion: Moderate
Water table: Perched within a depth of 1.5 feet during rainy periods
Shrink-swell potential: High

Included with this soil in mapping are small areas of Greenvine and Flatonia soils on slightly convex mounds. Also included are soils that have a distinct reddish color in the upper part of the subsoil, soils that have a sandy surface layer more than 20 inches thick, and a few small gullies that are 2 to 4 feet deep. Inclusions make up less than 20 percent of the map unit.

The Falba soil is used mainly as rangeland or pasture. There are a few idle fields that are no longer cropped.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Bahiagrass is planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum pasture and hay production.

The rangeland vegetation includes dense stands of post oak and cedar trees and invading yaupon and other shrubs. Grasses include bluestems, paspalums, and panicums. The rangeland produces medium yields if good management practices, such as deferred grazing, are applied.

This soil has many limitations affecting urban and recreational uses. The main limitations include the shrink-swell potential, the depth to bedrock, the very slow permeability, the perched seasonal high water table, and corrosivity. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil.

This soil is suitable for most kinds of recreational uses, but protection from wind erosion and water erosion is needed. Some erosion-control measures include using an overall vegetative cover and paving paths, trails, and roads with gravel, asphalt, or concrete.

The dense woody vegetation provides good habitat for armadillos, deer, dove, quail, raccoons, songbirds, and squirrels.

The capability subclass is IVe; Claypan Savannah range site.

FnB—Flatonia clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on foot slopes, low ridges, and upland divides. Slopes are mostly convex, but some areas are plane or slightly concave. This soil commonly occurs in the extreme northwestern part of the county. Individual areas are irregular in shape or somewhat oval. They range from 40 to more than 400 acres in size and average about 150 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 6 inches; very dark grayish brown, mildly alkaline clay loam

Subsoil:
6 to 27 inches; very dark gray, mildly alkaline sandy clay
27 to 42 inches; moderately alkaline sandy clay that is dark gray in the upper part and gray in the lower part

42 to 48 inches; light gray, moderately alkaline clay loam

Substratum:

48 to 80 inches; stratified, white loamy sediments and very pale brown, weakly cemented sandstone

Important soil properties—

Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Medium
Root zone: Deep
Hazard of water erosion: Moderate
Shrink-swell potential: High in the upper part of the subsoil and moderate in the lower part and in the surface layer

Included with this soil in mapping are small areas of Carbengle, Falba, and Greenvine soils. Carbengle soils are on small convex slopes. They are underlain by sandstone. Falba soils have a sandy surface layer. They are on the lower elevations and support thick stands of post oak and cedar trees. Greenvine soils have a clayey surface layer. They are mainly on small ridges at the higher elevations. Also included are a few small gullies that are about 2 to 4 feet deep. Inclusions make up less than 15 percent of the map unit.

The Flatonia soil is used mainly as pasture or rangeland, but a few small areas are used as cropland. Most of the pastured areas are fields that were once cultivated by early settlers. Forage and crop yields are medium or high, depending on management practices.

Improved pasture grasses are mainly bluestems, such as Gordo bluestem and Angleton bluestem, coastal bermudagrass, and kleingrass. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum pasture and hay production.

The rangeland vegetation includes bluestems, panicums, and paspalums and scattered live oak and post oak trees. The rangeland produces medium or high yields if good management practices, such as deferred grazing, are applied.

The areas used as cropland are limited in extent. The main crops are corn and grain sorghum. Some areas are planted to either forage sorghum or small grain. Good management practices include leaving crop residue on the surface, growing cover crops, farming on the contour, terracing, and establishing grassed waterways. These practices help to maintain productivity and tilth and to control water erosion. Applications of fertilizer, including nitrogen, phosphate, and potash, increase crop yields. Fertilizer should be applied based on laboratory test results.

This soil has some limitations affecting urban development. The main limitations include the high shrink-swell potential, the slow permeability, and corrosivity. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. The slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil provides good habitat for openland wildlife, such as dove, quail, and songbirds. Deer are not as common in areas of this soil as in the nearby wooded areas.

The capability subclass is IIe; Clay Loam range site.

FrB—Fordtran loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on uplands. It is in the southern and southeastern parts of the county. Individual areas are oval or irregular in shape. They range from 20 to 400 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 7 inches; brown, slightly acid loamy fine sand

Subsurface layer:

7 to 24 inches; very pale brown, slightly acid loamy fine sand

Subsoil:

24 to 33 inches; light gray, medium acid sandy clay
33 to 46 inches; white, slightly acid sandy clay
46 to 62 inches; white, neutral sandy clay loam
62 to 80 inches; light gray, neutral sandy clay loam

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: Low
Surface runoff: Slow or very slow

Root zone: Deep
Hazard of wind erosion: Moderate
Hazard of water erosion: Moderate
Water table: Perched within a depth of 3.5 feet during rainy periods
Shrink-swell potential: Moderate in the subsoil

Included in mapping are small areas of Cieno, Edna, Milby, Nada, and Telferner soils. Cieno soils are in small rounded depressions. The other included soils are in landscape positions that are slightly lower than or similar to those of the Fordtran soil. The included soils make up less than 20 percent of the map unit.

The Fordtran soil is used mainly as rangeland. A few areas are used as cropland or improved pasture.

The rangeland vegetation consists of open prairie grass and invading scrub live oak. Forage yields are medium. Good management practices include deferred grazing, especially during periods of extensive drought.

This soil is moderately suited to cropland. Only a few small areas are planted to rice, corn, and grain sorghum. The low natural fertility level and the droughtiness limit production. Runoff is very slow in large, nearly level areas. The very slow runoff results in excess surface water. Good management practices include leaving crop residue on the surface, applying a system of timely and limited tillage, and rotating crops. Fertilizer is needed for maximum crop production and should be applied based on laboratory test results. Drainage ditches are beneficial in local areas where roads or other structures obstruct drainage.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Bahiagrass, kleingrass, or bluestems are planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum hay and pasture production.

This soil has many limitations affecting most urban and recreational uses. The main limitations are the perched seasonal high water table, inadequate drainage, corrosivity, the very slow permeability, and the sandy surface layer. The very slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil.

This soil provides fair or good habitat for deer, dove, quail, and other wildlife. Several thousand geese, ducks, and other fowl migrate to this area in the winter. They nest in areas of the included Cieno soils.

The capability subclass is IIIw; Sandy Prairie range site.

FsB—Frelsburg clay, 1 to 3 percent slopes. This deep, gently sloping soil is on foot slopes and low ridges in the uplands. It is mainly in the northern part of the county. It is often associated with soils that formed over sandstone, such as the Carbengle soils. In many places, areas of this soil are parallel to ridges and drainageways. The areas range from 20 to 500 acres in size and average about 200 acres.

In undisturbed areas gilgai microrelief consisting of small knolls and subrounded depressions is common. In cultivated fields this microrelief is barely detectable because plowing has smoothed the surface.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 8 inches; dark gray, mildly alkaline clay

Subsoil:
8 to 52 inches; gray clay that is mildly alkaline in the upper part and moderately alkaline below a depth of 20 inches
52 to 71 inches; light brownish gray clay that is moderately alkaline in the upper part and mildly alkaline below a depth of 61 inches
71 to 80 inches; white, moderately alkaline clay

Important soil properties—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Medium
Root zone: Deep, but the clayey subsoil restricts root penetration
Hazard of water erosion: Moderate
Shrink-swell potential: Very high

Included in mapping are small areas of Bleiblerville, Branyon, Carbengle, Cuero, Denhawken, and Elmendorf soils. Bleiblerville and Branyon soils are in the lower landscape positions. Carbengle, Cuero,

Figure 10.—Grain sorghum in an area of Frelsburg clay, 1 to 3 percent slopes.

Denhawken, and Elmendorf soils are on the slightly higher, small convex slopes. Also included are some Frelsburg soils that have a surface layer of clay loam and some soils that have a few yellow and brown mottles. The included soils make up less than 15 percent of the map unit.

The Frelsburg soil is used mainly as cropland or improved pasture. Some areas are used as rangeland.

Corn and grain sorghum are the main crops (fig. 10). Some areas have produced corn yields of more than 100 bushels per acre. Some areas are planted to forage sorghum in the summer and small grain in the winter. Good management practices include leaving crop residue on the surface, growing cover crops, farming on the contour, terracing, and establishing grassed waterways. These practices help to maintain the productivity of the soil and control erosion. Applications of fertilizer, especially nitrogen, increase crop yields. Fertilizer applications should be based on laboratory test results and local test plot demonstrations. For example, local tests have indicated that zinc, a trace element, greatly influences crop yields in places.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo bluestem, other bluestems, and kleingrass have produced good forage yields. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is a very important management practice.

The rangeland vegetation consists of open prairie plants, including bluestems and switchgrass. Forage yields are medium or high, depending on management practices. Deferred grazing is needed to ensure continued forage production.

This soil has some limitations affecting urban and recreational uses. The very slow permeability, the shrink-swell potential, corrosivity, and the clayey texture are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The main kinds of wildlife are coyotes, dove, quail, and rabbits. Deer are not prevalent because the open prairie vegetation generally does not provide cover.

The capability subclass is IIe; Blackland (Blackland Prairie) range site.

FsC—Frelsburg clay, 3 to 5 percent slopes. This very deep, gently sloping soil is on the upper part of slopes and on broad ridges in the uplands. It is mainly in the northern part of the county. It is often associated with soils that formed over sandstone, such as the Carbengle soils. In many places, areas of this soil are parallel to ridges and drainageways. The areas range from 20 to 300 acres in size and average about 200 acres.

In undisturbed areas gilgai microrelief consisting of small knolls and subrounded depressions is common. In cultivated fields this microrelief is barely detectable.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 12 inches; dark gray to very dark gray, moderately alkaline clay

Subsoil:
12 to 58 inches; gray, moderately alkaline clay

Substratum:
58 to 80 inches; light gray, moderately alkaline clay

Important soil properties—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Medium or rapid
Root zone: Deep, but the clayey subsoil restricts root penetration
Hazard of water erosion: Moderate
Shrink-swell potential: Very high

Included in mapping are small areas of Bleiblerville, Carbengle, Cuero, and Latium soils. Bleiblerville soils are in the lower landscape positions. Carbengle, Cuero, and Latium soils are on the slightly higher, small convex slopes. Also included are some Frelsburg soils that have a surface layer of clay loam and some soils that have a few yellow and brown mottles. The included soils make up less than 15 percent of the map unit.

The Frelsburg soil is used mainly for improved pasture. Some areas are used as cropland or rangeland.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo bluestem, other bluestems, and kleingrass have produced good forage yields. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is a very important management practice.

Corn and grain sorghum are the main crops. Some areas are planted to forage sorghum in the summer and small grain in the winter. Good management practices include leaving crop residue on the surface, growing cover crops, farming on the contour, terracing, and establishing grassed waterways. These practices help to maintain the productivity of the soil and control erosion. Applications of fertilizer, especially nitrogen, increase crop yields. Fertilizer applications should be based on laboratory test results and local test plot demonstrations. For example, local tests have indicated

that zinc, a trace element, greatly influences crop yields in places.

The rangeland vegetation consists of open prairie plants, including bluestems and switchgrass. Forage yields are medium or high, depending on management practices. Deferred grazing is needed to ensure continued forage production.

This soil has many limitations affecting urban and recreational uses. The very slow permeability, the shrink-swell potential, the slope, corrosivity, and the clayey texture are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The main kinds of wildlife are coyotes, dove, quail, and rabbits. Deer are not prevalent because the open prairie vegetation generally does not provide cover.

The capability subclass is IIIe; Blackland (Blackland Prairie) range site.

FsD—Frelsburg clay, 5 to 8 percent slopes. This very deep, strongly sloping soil is on the upper part of slopes and on high ridges in the uplands. It is mainly in the northern part of the county. It is often associated with soils that formed over sandstone, such as the Carbengle soils. In many places, areas of this soil are parallel to ridges and drainageways. The areas range from 20 to 200 acres in size and average about 50 acres.

In undisturbed areas gilgai microrelief consisting of small knolls and subrounded depressions is common. In cultivated fields this microrelief is barely detectable.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 10 inches; dark gray, moderately alkaline clay

Subsoil:
10 to 52 inches; gray to light brownish gray, moderately alkaline clay

Substratum:
52 to 80 inches; white, moderately alkaline clay

Important soil properties—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Rapid
Root zone: Deep, but the clayey subsoil restricts root penetration
Hazard of water erosion: Severe
Shrink-swell potential: Very high

Included in mapping are small areas of Bleiblerville, Carbengle, Cuero, and Latium soils. Carbengle soils are on the slightly higher, small convex slopes. Bleiblerville, Cuero, and Latium soils are mainly in the lower landscape positions. Latium soils are along gullies or in other small areas where erosion is extensive. Also included are some Frelsburg soils that have a surface layer of clay loam and some soils that have a few yellow and brown mottles. The included soils make up less than 15 percent of the map unit.

The Frelsburg soil is used mainly as rangeland. Some areas are used as improved pasture.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo bluestem, other bluestems, and kleingrass have produced good forage yields. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is a very important management practice.

The rangeland vegetation consists of open prairie plants, including bluestems and switchgrass. Forage yields are medium or low, depending on management practices. Deferred grazing is needed to ensure continued forage production.

This soil has many limitations affecting urban and recreational uses. The very slow permeability, the shrink-swell potential, the slope, corrosivity, and the clayey texture are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability

may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The main kinds of wildlife are coyotes, dove, quail, and rabbits. Deer are not prevalent because the open prairie vegetation does not provide cover.

The capability subclass is IVe; Blackland (Blackland Prairie) range site.

GrB—Greenvine clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on foot slopes and low ridges in the uplands. It is mainly in the northwestern part of the county. In many areas it is adjacent to soils that formed over sandstone, such as the Carbengle soils. Individual areas are parallel to ridges and drainageways. They range from 20 to 400 acres in size and average about 100 acres.

In undisturbed areas gilgai microrelief consisting of small knolls and subrounded depressions is common. In cultivated fields this microrelief is barely detectable.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
- 0 to 6 inches; very dark gray, neutral clay loam that has a content of clay greater than 35 percent
- 6 to 13 inches; very dark gray, mildly alkaline clay

Subsoil:
- 13 to 28 inches; mildly alkaline clay that is dark gray in the upper part and grayish brown below a depth of 20 inches
- 28 to 35 inches; light brownish gray, mildly alkaline clay
- 35 to 48 inches; pale yellow, mildly alkaline silty clay

Substratum:
- 48 to 67 inches; pale yellow, mildly alkaline, clayey tuff

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Moderate
Surface runoff: Medium
Root zone: Moderately deep, but the clayey subsoil restricts root penetration
Hazard of water erosion: Moderate
Shrink-swell potential: Very high

Included in mapping are small areas of Carbengle, Falba, and Flatonia soils. Carbengle soils are underlain by sandstone. They are on the slightly higher, small convex slopes. Falba and Flatonia soils are in the lower landscape positions. The included soils make up less than 15 percent of the map unit.

The Greenvine soil is mainly idle cropland. A few areas are used as either cropland, improved pasture, or rangeland.

Corn and grain sorghum are the main crops. Some areas are planted to forage sorghum in the summer and small grain in the winter. Good management practices include leaving crop residue on the surface, growing cover crops, farming on the contour, terracing, and establishing grassed waterways. These practices help to maintain the productivity of the soil and control erosion. Applications of fertilizer, especially nitrogen, increase crop yields. Fertilizer applications should be based on laboratory test results and local test plot demonstrations.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo bluestem, other bluestems, and kleingrass have produced good forage yields. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is a very important management practice.

The rangeland vegetation consists of open prairie plants, including bluestems and switchgrass. Forage yields are medium or high, depending on management practices. Deferred grazing is needed to ensure continued forage production.

This soil has some limitations affecting urban and recreational uses. The very slow permeability, the shrink-swell potential, corrosivity, and the clayey texture are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be

needed. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The main kinds of wildlife are coyotes, dove, quail, and rabbits. Deer are not prevalent because the open prairie vegetation does not provide cover.

The capability subclass is IIe; Blackland (Blackland Prairie) range site.

GrC—Greenvine clay loam, 3 to 5 percent slopes. This moderately deep, gently sloping soil is on the upper slopes and high ridges in the uplands. It is mainly in the northwestern part of the county. It is often adjacent to soils that formed over sandstone, such as the Carbengle soils. Individual areas are parallel to ridges and drainageways. They range from 20 to 100 acres in size and average about 50 acres.

In undisturbed areas gilgai microrelief consisting of small knolls and subrounded depressions is common. In cultivated fields this microrelief is barely detectable.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 8 inches; very dark gray, moderately alkaline clay loam that has a content of clay greater than 35 percent

Subsoil:

8 to 32 inches; moderately alkaline clay that is dark gray in the upper part and grayish brown in the lower part

Substratum:

32 to 80 inches; light brownish gray to light gray, moderately alkaline, clayey tuff

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Moderate
Surface runoff: Rapid
Root zone: Moderately deep, but the clayey subsoil restricts root penetration
Hazard of water erosion: Severe
Shrink-swell potential: Very high

Included in mapping are small areas of Carbengle, Falba, and Flatonia soils. Carbengle soils are on the slightly higher, small convex slopes. Falba and Flatonia soils are in the lower landscape positions. They have a less clayey subsoil than that of the Greenvine soil. Falba soils also have a sandy surface layer. Also included are a few small gullies 2 to 5 feet deep along field boundaries and drainageways. Inclusions make up less than 20 percent of the map unit.

The Greenvine soil is mainly idle cropland. A few areas are used for improved pasture or rangeland.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo bluestems, other bluestems, and kleingrass have produced good forage yields. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is a very important management practice.

The rangeland vegetation consists of open prairie plants, including bluestems and switchgrass. Forage yields are medium or low. Deferred grazing is needed to ensure continued forage production.

This soil has many limitations affecting urban and recreational uses. The very slow permeability, the shrink-swell potential, corrosivity, the slope, and the clayey texture are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The main kinds of wildlife are coyotes, dove, quail, and rabbits. Deer are not prevalent because of the open prairie vegetation.

The capability subclass is IIIe; Blackland (Blackland Prairie) range site.

GrD4—Greenvine-Gullied land complex, 3 to 8 percent slopes. These eroded soils are most common where old fields are adjacent to creeks and their tributaries. They formed in tuff, tuffaceous siltstone, and tuffaceous shales of the Catahoula formation. They are highly susceptible to water erosion. In some areas erosion is related to past farming practices, but in other areas of rangeland, extensive geologic erosion has occurred.

Greenvine soils make up about 45 percent of the total acreage and 35 to 50 percent of individual areas. Gullies make up about 32 percent of the total acreage and 20 to 50 percent of individual areas. The gullies range from 3 to 10 feet deep and average 5 feet deep. Other eroded soils make up 10 to 20 percent of the unit. Sheet erosion is common, and 30 to 100 percent of the original surface soil has been eroded. Individual areas are elongated or irregular in shape and are parallel to creeks, drains, and old fields. They range from 10 to more than 100 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of the Greenvine soil are—

Surface layer:
0 to 5 inches; very dark gray, moderately alkaline clay

Subsoil:
5 to 31 inches; moderately alkaline clay that is dark gray in the upper part and light gray in the lower part

Substratum:
31 to 80 inches; white tuff that has a silty clay texture with strata of silty clay loam

Important soil properties of the Greenvine soil—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Low
Surface runoff: Rapid
Root zone: Moderately deep, but the exposed subsoil restricts root penetration
Hazard of water erosion: Severe
Shrink-swell potential: Very high

Included in mapping are small eroded areas of Carbengle and Flatonia soils. The areas occur along the edge of large gullies. Carbengle soils are in the higher positions on the landscape, and Flatonia soils are in the lower positions. The included soils make up less than 20 percent of the map unit.

This unit is used mainly for rangeland or wildlife habitat. Forage production is low. Mechanically reshaping and vegetating the gullies help to control further erosion. Fencing these areas is necessary to prevent overgrazing and further erosion.

This unit has severe limitations affecting urban and recreational uses. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability and the high water table may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of the Greenvine soil.

This unit and adjacent wooded areas along creeks provide fair habitat for deer, dove, quail, and other wildlife.

The capability subclass is VIe; Eroded Blackland range site.

HaB—Hallettsville fine sandy loam, 1 to 3 percent slopes. This very deep, gently sloping soil is on foot slopes, low ridges, and divides. Slopes are mostly plane or convex, but some areas are slightly concave. This soil is commonly on foot slopes below Denhawken and Elmendorf soils, which are on the higher ridges. Individual areas are oblong or oval and are parallel to ridges and drainageways. They range from 20 to 200 acres in size and average about 80 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 8 inches; very dark grayish brown, neutral fine sandy loam

Subsoil:
8 to 13 inches; dark gray, neutral sandy clay
13 to 35 inches; grayish brown, neutral sandy clay that has yellowish brown and olive brown mottles
35 to 54 inches; moderately alkaline sandy clay loam that is grayish brown to a depth of 45 inches and light brown with pale brown, light gray, and red mottles to a depth of 54 inches
54 to 64 inches; white, moderately alkaline sandy

clay loam that has brownish yellow, dark yellowish brown, and red mottles
64 to 74 inches; white, mildly alkaline sandy clay loam

Substratum:
74 to 80 inches; light yellowish brown, neutral fine sandy loam

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Moderate
Surface runoff: Slow or medium
Root zone: Deep
Hazard of wind erosion: Slight
Hazard of water erosion: Moderate
Shrink-swell potential: High in the upper part of the subsoil and moderate in the lower part and in the surface layer

Included with this soil in mapping are small areas of Cuero, Denhawken, Dubina, Elmendorf, and Straber soils. These soils are in landscape positions slightly higher than or similar to those of the Hallettsville soil. Some areas of the Dubina soils are on small, rounded, slightly convex mounds about 1 acre in size. Also included are a few small areas of Hallettsville soils that have a slope of as much as 5 percent, some soils that are similar to the Hallettsville soil but are clay or sandy clay below a depth of 40 inches, and some narrow bands of Navidad soils along small creeks and drainageways. The included soils make up about 15 percent of the map unit.

The Hallettsville soil is used as cropland, pasture, or rangeland.

Corn and grain sorghum are the main crops. Some areas are planted to forage sorghum. This soil has good tilth and can be worked throughout a wide range of moisture conditions. Leaving crop residue on the surface and growing cover crops help to control erosion and maintain the productivity and tilth of the soil. Farming on the contour, terracing, and establishing grassed waterways help to control erosion. Applications of fertilizer, such as nitrogen, phosphate, and potash, increase yields and should be applied based on laboratory test results.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses and kleingrass. Applications of fertilizer and rotation grazing are recommended for maximum pasture and hay production.

The rangeland vegetation consists of savannah plants, including large live oak and post oak trees and bluestems, gramas, paspalums, and panicums. Yields are medium or high if good management practices, such as deferred grazing, are applied.

This soil has some limitations affecting most urban and recreational uses. The very slow permeability, the high shrink-swell potential, and corrosivity are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions.

This soil produces good stands of large live oak and post oak trees. It also produces good stands of grasses and forbs interspersed with some invading brush, such as yaupon. This vegetation provides good habitat for deer, dove, quail, songbirds, and squirrels.

The capability subclass is IIe; Claypan Savannah range site.

InB—Inez loamy fine sand, 0 to 2 percent slopes. This very deep, nearly level to gently sloping soil is on uplands. It is in the southern and southeastern parts of the county. Individual areas are oval or irregular in shape. They range from 20 to more than 400 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 10 inches; light brownish gray, slightly acid loamy fine sand

Subsurface layer:
10 to 14 inches; white, slightly acid loamy fine sand

Subsoil:
14 to 53 inches; light gray sandy clay that has yellowish red, reddish yellow, strong brown, and red mottles and that is very strongly acid in the upper part and strongly acid below a depth of 41 inches

53 to 80 inches; white, mildly alkaline sandy clay loam that has red mottles

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Slow
Root zone: Deep
Hazard of wind erosion: Moderate
Hazard of water erosion: Slight
Water table: Perched within a depth of 1.5 feet during rainy periods
Shrink-swell potential: High in the upper part of the subsoil and moderate in the lower part

Included in mapping are small areas of Cieno, Dacosta, Edna, Kuy, Milby, and Morales soils. Cieno soils are in small rounded depressions. The other included soils are in landscape positions that are slightly lower than or similar to those of the Inez soil. The included soils make up less than 15 percent of the map unit.

The Inez soil is used mainly for rangeland. A few areas are used as cropland or improved pasture.

The rangeland consists of woody vegetation, including post oak, live oak, and invading yaupon, interspersed with bluestems, paspalums, and panicums (fig. 11). Forage yields are medium. Good management practices include deferred grazing, especially during dry periods.

This soil is moderately suited to cropland. The main crops are rice, corn, and grain sorghum. The low natural fertility level and the droughtiness limit production. Runoff is slow, which results in excess surface water after rainy periods. Good management practices include leaving crop residue on the surface, applying a system of timely and limited tillage, and rotating crops. Fertilizer is needed for maximum crop production and should be applied based on laboratory test results. Drainage ditches are beneficial where adequate outlets are available.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Bahiagrass, kleingrass, or bluestems are planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum hay and pasture production.

This soil has some limitations affecting most urban and recreational uses. The main limitations are the perched seasonal high water table, inadequate drainage, the very slow permeability, corrosivity, and the shrink-swell potential. The very slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. The soil does not provide an ideal surface for camp areas or for other recreational uses. Soil blowing can be a nuisance in recreational areas where the surface is not adequately protected. A vegetative cover can reduce the hazards of wind erosion and water erosion.

This soil provides good habitat for deer, dove, quail, squirrels, and wild turkeys. Several thousand geese, ducks, and other fowl migrate to this area in the winter.

The capability subclass is IIIw; Sandy Loam range site.

KuC—Kuy loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on terraces near rivers and creeks in the southern part of the county. Slopes are convex and, in places, are gently undulating. Individual areas are either oval or elongated and are parallel to streams. They range from 20 to 300 acres in size and average about 150 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 6 inches; light brownish gray, medium acid loamy fine sand

Subsurface layer:
6 to 52 inches; very pale brown, neutral loamy fine sand

Subsoil:
52 to 80 inches; light gray, very strongly acid sandy clay loam that has red, reddish brown, and reddish yellow mottles

Important soil properties—

Drainage class: Moderately well drained
Permeability: Moderate

Figure 11.—An area of Inez loamy fine sand, 0 to 2 percent slopes, used as rangeland. This Sandy Loam range site has been reseeded and is well established. A deer hunter's blind is in the background.

Available water capacity: Low
Surface runoff: Slow
Root zone: Deep
Hazard of wind erosion: Severe
Hazard of water erosion: Slight
Water table: Apparent within a depth of 3 to 5 feet during rainy periods
Shrink-swell potential: Low

Included with this soil in mapping are small areas of Dutek, Inez, Milby, and Morales soils. These soils are in landscape positions that are slightly higher than or similar to those of the Kuy soil. They have a sandy surface layer that is less than 40 inches thick. Also included are some soils that are similar to the Kuy soil but have a subsoil of sandy clay. The included soils make up about 10 percent of the map unit.

The Kuy soil is used mainly as rangeland. A few areas are used as improved pasture.

Improved pasture grasses include lovegrass and bahiagrass. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum pasture and hay production.

The rangeland overstory vegetation consists mainly of live oak, blackjack oak, and post oak. Bluestems and paspalums are the main grasses. Yields are low in most years because of the droughtiness.

This soil has limitations for many urban and recreational uses. The thick sandy surface layer, seepage, corrosivity, and the seasonal high water table are the main limitations. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. The sandy texture of this soil provides a poor filter for septic tank absorption fields. This soil does not provide an ideal surface for camp areas or for other recreational uses. Soil blowing can be a nuisance in recreational areas where the surface is not adequately protected. A vegetative cover can reduce the hazards of wind erosion and water erosion.

This soil produces good stands of oak and other trees. Grasses include bluestems, indiangrass, and paspalums. The soil provides good habitat for deer, dove, quail, and squirrels.

The capability subclass is IIIs; Deep Sand range site.

LaA—Lake Charles clay, 0 to 1 percent slopes. This very deep, nearly level soil is on uplands. It is minor in extent and occurs only in the southeastern part of the county. Individual areas are oval or irregular in shape. They range from 20 to 200 acres in size and average about 50 acres.

In undisturbed areas gilgai microrelief consisting of small knolls and rounded depressions is common. In cultivated fields this microrelief is barely detectable.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 30 inches; dark gray to very dark gray, medium acid clay that has dark yellowish brown mottles in the lower part

Subsoil:
30 to 53 inches; gray, mildly alkaline clay
53 to 62 inches; light gray, moderately alkaline clay

Substratum:
62 to 80 inches; very pale brown, moderately alkaline clay

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Very slow
Root zone: Deep
Hazard of water erosion: Slight
Water table: Perched within a depth of 2 feet during rainy periods
Shrink-swell potential: Very high

Included in mapping are small areas of Cieno, Dacosta, Edna, and Telferner soils. Cieno soils are in small rounded depressions. Dacosta, Edna, and Telferner soils are in landscape positions that are slightly higher than or similar to those of the Lake Charles soil. The included soils make up less than 15 percent of the map unit.

The Lake Charles soil is used mainly as rangeland. A few areas are used as cropland or improved pasture.

The rangeland vegetation consists of open prairie plants, including bluestems, paspalums, and panicums and a few live oak trees. Forage yields are medium or high, depending on management practices. Good management practices include deferred grazing, especially during dry periods.

This soil is well suited to cropland. The main crops are corn and grain sorghum. Maintaining favorable soil structure and tilth is difficult in places, and a surface crust and plowpan are common. Runoff is very slow in large, nearly level fields, resulting in excess surface water after rainy periods. Good management practices include leaving crop residue on the surface, applying a system of timely and limited tillage, and rotating crops. Fertilizer is needed for maximum crop production and should be applied based on laboratory test results. Drainage ditches are beneficial where adequate outlets are available.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo or other bluestems are planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum hay and pasture production.

This soil has many limitations affecting most urban and recreational uses. The main limitations are the perched seasonal high water table, inadequate drainage, the very slow permeability, the clayey texture, corrosivity, and the shrink-swell potential. The very slow permeability and the high water table can cause failure

of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil provides good habitat for dove, ducks, geese, and quail. Several thousand geese, ducks, and other fowl migrate to this area in the winter. The Attwater prairie chicken nests in a few well managed areas. Mottled ducks make limited use of this habitat for nests, cover, and food.

The capability subclass is IIw; Blackland (Coast Prairie) range site.

LtC3—Latium clay, 3 to 5 percent slopes, eroded. This very deep, gently sloping, eroded soil is on convex slopes and long, narrow ridges. Erosion has removed most of the original surface layer. Many of the areas are formerly cultivated fields. Most areas are rilled and have gullies 2 to 4 feet deep, 3 to 10 feet wide, and 50 to 200 feet apart. Some gullies can be crossed by farm machinery. Some areas have been smoothed and planted to improved grasses. Individual areas range from 20 to 200 acres in size and average about 40 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 5 inches; grayish brown, moderately alkaline clay

Subsoil:
5 to 23 inches; pale yellow, moderately alkaline clay
23 to 44 inches; light gray, moderately alkaline clay

Substratum:
44 to 80 inches; pale yellow and very pale brown, moderately alkaline clay

Important soil properties—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Rapid
Root zone: Deep
Hazard of water erosion: Severe
Shrink-swell potential: Very high

Included in mapping are small areas of Bleiblerville, Carbengle, Cuero, and Frelsburg soils. Carbengle soils are on small, convex slopes on the slightly higher parts of the landscape. Bleiblerville and Cuero soils are in the lower landscape positions. Frelsburg soils are in landscape positions similar to those of the Latium soil. Also included are a few gullies that are 10 to 20 feet deep. Inclusions make up less than 15 percent of the map unit.

The Latium soil is used mainly as rangeland or improved pasture. Mechanical reshaping of gullies is needed to establish improved pasture.

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo bluestem, other bluestems, and kleingrass have produced good forage yields. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is a very important management practice.

The rangeland vegetation consists of open prairie plants, including bluestems and switchgrass. Forage yields are medium or high, depending on management practices. Deferred grazing is needed to ensure continued forage production.

This soil is limited as a site for most urban and recreational uses. The shrink-swell potential, the very slow permeability, corrosivity, the slope, and susceptibility to erosion are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of

this soil. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The main kinds of wildlife are coyotes, dove, quail, and rabbits. The limited plant cover keeps deer from using areas of this soil as permanent habitat.

The capability subclass is IVe; Eroded Blackland range site.

LtD4—Latium clay, 5 to 8 percent slopes, severely eroded. This very deep, strongly sloping, eroded soil is on high slopes and long, narrow ridges adjacent to drainageways. Erosion has removed most of the original surface layer. Many of the areas are formerly cultivated fields. Most areas are rilled and have gullies 3 to 6 feet deep, 3 to 20 feet wide, and 50 to 200 feet apart. Most of the gullies cannot be crossed by farm machinery. Some areas have been smoothed and planted to improved grasses. Individual areas range from 10 to 200 acres in size and average about 40 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 4 inches; dark gray, moderately alkaline clay

Subsoil:
4 to 48 inches; grayish brown, moderately alkaline clay

Substratum:
48 to 80 inches; pale olive, moderately alkaline clay

Important soil properties—

Drainage class: Well drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Rapid
Root zone: Deep
Hazard of water erosion: Severe
Shrink-swell potential: Very high

Included in mapping are small areas of Bleiblerville, Carbengle, Cuero, and Frelsburg soils. Carbengle soils are on small, convex slopes on the slightly higher parts of the landscape. Bleiblerville, Cuero, and Frelsburg soils are in the lower landscape positions. Also included are a few gullies that are 10 to 20 feet deep. Inclusions make up less than 15 percent of the map unit.

The Latium soil is used mainly as rangeland or improved pasture. Mechanical reshaping is needed before establishing improved pasture (fig. 12).

Improved pasture grasses include coastal bermudagrass and other bermudagrasses. Gordo bluestem, other bluestems, and kleingrass have produced good forage yields. Periodic applications of fertilizer throughout the growing season are needed for maximum pasture and hay production. Rotation grazing also is a very important management practice.

The rangeland vegetation consists of open prairie plants, including bluestems and switchgrass. Forage yields are medium or high, depending on management practices. Deferred grazing is needed to ensure continued forage production.

This soil is limited as a site for most urban and recreational uses. The shrink-swell potential, the very slow permeability, the slope, and extensive erosion are the main limitations. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. Trench sidewalls are very unstable under certain conditions. The sidewalls of trenches excavated to a depth of 5 feet or more should be shored or graded at an angle that ensures safe working conditions. Because of the clayey texture, recreational areas become very slippery and sticky when wet. When the soil is very dry, the formation of large cracks may restrict some playground activities.

This soil has good potential for openland wildlife habitat and fair potential for rangeland wildlife habitat. The main kinds of wildlife are coyotes, dove, quail, and rabbits. The limited plant cover keeps deer from using areas of this soil as permanent habitat.

The capability subclass is VIe; Eroded Blackland range site.

MbB—Milby loamy sand, 0 to 3 percent slopes. This very deep, nearly level to gently sloping soil is in the uplands. It is in the southern and southeastern parts of the county. Individual areas are oval or irregular in shape. They range from 20 to more than 400 acres in size and average about 100 acres.

Figure 12.—An area of Latium clay, 5 to 8 percent slopes, severely eroded. Note the gullies in the background have been reshaped.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 7 inches; pale brown, slightly acid loamy fine sand

Subsurface layer:

7 to 15 inches; very pale brown, medium acid loamy fine sand that has dark yellowish brown mottles

15 to 29 inches; very pale brown, slightly acid loamy fine sand that has red and yellowish red mottles

Subsoil:

29 to 66 inches; light gray, very strongly acid sandy clay loam

Substratum:

66 to 80 inches; reddish yellow, strongly acid sandy clay loam

Important soil properties—

Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: Low
Surface runoff: Slow
Root zone: Deep
Hazard of wind erosion: Moderate
Hazard of water erosion: Moderate
Water table: Perched within a depth of 2 to 3 feet during rainy periods
Shrink-swell potential: Moderate in the subsoil

Included in mapping are small areas of Dacosta, Dutek, Inez, Kuy, and Morales soils. Dacosta soils are in small, elongated depressions. Dutek, Inez, Kuy, and Morales soils are in landscape positions that are slightly lower than or similar to those of the Milby soil. The included soils make up less than 15 percent of the map unit.

The Milby soil is used mainly as rangeland. A few areas are used as improved pasture.

The rangeland consists of woody vegetation, including post oak, live oak, and invading yaupon. Grasses include bluestems, lovegrass, paspalums, and panicums. Forage yields are medium. Good management practices include deferred grazing, especially during dry periods.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Bahiagrass, kleingrass, or bluestems are planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum hay and pasture production.

This soil has many limitations affecting most urban and recreational uses. The main limitations are the perched seasonal high water table, inadequate drainage, seepage, and a sandy surface layer. The slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. The sandy texture of this soil provides a poor filter for septic tank absorption fields. This soil does not provide an ideal surface for camp areas or for other recreational uses. Soil blowing can be a nuisance in recreational areas where the surface is not adequately protected. A vegetative cover can reduce the hazards of wind erosion and water erosion.

This soil provides good habitat for deer, dove, quail, squirrels, and wild turkeys. Many deer are present in these wooded areas, and deer hunting is common.

The capability subclass is IIIs; Sandy range site.

McA—Morales-Cieno complex, 0 to 1 percent slopes. These soils are on nearly level, broad, extensive uplands associated with the Lissie Formation. Individual areas range from 20 to more than 1,000 acres in size.

The Morales soil makes up about 57 percent of the total acreage and 40 to 75 percent of individual areas. The Cieno soil makes up about 28 percent of the total acreage and 10 to 50 percent of individual areas. In undisturbed areas the Morales soil is in nearly level, wooded areas. The Cieno soil is in slightly concave, rounded depressions with very little, if any, woody vegetation. These areas range from about 50 feet to a few hundred feet across. The areas used for rice production have been leveled for irrigation, and the Cieno soil in these areas has had 6 to 12 inches of fill material added to the soil surface. The Morales and Cieno soils occur as areas so intricately mixed that mapping them separately is not practical at the selected scale.

The typical sequence, depth, and composition of the layers of the Morales soil are—

Surface layer:
0 to 4 inches; pale brown, neutral fine sandy loam

Subsurface layer:
4 to 8 inches; very pale brown, neutral fine sandy loam

Subsoil:
8 to 16 inches; light gray, slightly acid sandy clay loam that has brownish yellow mottles
16 to 23 inches; light brownish gray, slightly acid sandy clay that has yellowish red mottles
23 to 42 inches; light gray, neutral sandy clay loam that has brownish yellow mottles
42 to 54 inches; light gray, moderately alkaline sandy clay loam that has brownish yellow and yellowish red mottles
54 to 80 inches, white, moderately alkaline sandy clay loam that has yellow and yellowish red mottles

Important properties of the Morales soil—

Drainage class: Somewhat poorly drained
Permeability: Slow
Available water capacity: High
Surface runoff: Slow
Root zone: Deep
Hazard of water erosion: Slight
Water table: Perched within a depth of 1.5 feet during rainy periods
Shrink-swell potential: Moderate

The typical sequence, depth, and composition of the layers of the Cieno soil are—

Surface layer:
0 to 6 inches; light brownish gray, neutral loam

Subsoil:
6 to 64 inches; light gray, neutral sandy clay loam that has strong brown and brownish yellow mottles
64 to 80 inches; white, neutral sandy clay loam that has brownish yellow mottles

Important properties of the Cieno soil—

Drainage class: Poorly drained
Permeability: Very slow
Available water capacity: High

Surface runoff: Ponded
Root zone: Deep
Hazard of water erosion: Slight
Water table: Perched within a depth of 1 foot above the surface to 1.5 feet below the surface during winter and spring; water may be above the surface for several days to several months
Shrink-swell potential: Moderate

Included in mapping are small areas of Dacosta, Inez, Milby, and Nada soils. These soils are in landscape positions similar to those of the Morales soil. They make up about 15 percent of the map unit.

The Morales and Cieno soils are used as cropland, rangeland, or pasture. Some areas of the Cieno soil are excavated for ponds that are used as livestock water, irrigation reservoirs, and wildlife habitat.

These soils are well suited to the production of crops such as rice. Land leveling is necessary if the soils are irrigated. Good management practices include leaving crop residue on the surface. Incorporating crop residue into the soil helps to maintain favorable soil structure and tilth and increases the rate of water intake. Fertilizer is needed for maximum crop production. These soils also are well suited to improved pasture grasses, such as coastal bermudagrass and bahiagrass.

The rangeland vegetation on the Morales soil includes post oak, live oak, and other trees. Paspalums and bluestems are common. The vegetation on the Cieno soil consists of distinctly open prairie plants. The most common kind of vegetation is invading sienna beans.

The Morales soil has some limitations affecting urban and recreational uses. The main limitations are the wetness, poor drainage, the slow permeability, and corrosivity. The Cieno soil is poorly suited to most uses because of the ponding. The high water table and the restricted permeability of both soils can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of these soils.

These soils provide good habitat for dove, quail, deer, and other types of wildlife. Several thousand ducks and geese migrate to this area in the winter.

The capability unit is IIIw. The Morales soil is in the Sandy Loam range site and the Cieno soil in the Lowland range site.

NaA—Nada-Cieno complex, 0 to 1 percent slopes. These soils are on nearly level uplands associated with the Lissie Formation. Individual areas are limited in extent and are mostly along the Jackson County line. They range from 20 to 60 acres in size.

The Nada soil makes up about 52 percent of the total acreage and 45 to 60 percent of individual areas. The Cieno soil makes up about 38 percent of the total acreage and 35 to 40 percent of individual areas. In undisturbed areas the Nada soil is in nearly level or slightly concave areas. The Cieno soil is in slightly concave, rounded depressions ranging from about 50 feet to a few hundred feet across. The areas used for rice production have been leveled for irrigation, and the Cieno soil in these areas has had 6 to 12 inches of fill material added to the soil surface. The Nada and Cieno soils occur as areas so intricately mixed that mapping them separately is not practical at the selected scale.

The typical sequence, depth, and composition of the layers of the Nada soil are—

Surface layer:
0 to 7 inches; light brownish gray, slightly acid fine sandy loam

Subsoil:
7 to 26 inches; dark gray, slightly acid clay loam
26 to 41 inches; gray, neutral sandy clay loam
41 to 49 inches; light gray, moderately alkaline sandy clay loam
49 to 80 inches; white, moderately alkaline sandy clay loam that has reddish yellow mottles

Important properties of the Nada soil—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Slow
Root zone: Deep
Hazard of water erosion: Slight
Water table: Perched within a depth of 1 foot in winter and spring
Shrink-swell potential: Moderate

The typical sequence, depth, and composition of the layers of the Cieno soil are—

Surface layer:
0 to 6 inches; light gray, slightly acid loam

Subsoil:
6 to 62 inches; gray, medium acid to neutral sandy clay loam and clay loam that has strong brown and brownish yellow mottles

62 to 80 inches; light gray, neutral sandy clay loam that has brownish yellow mottles

Important properties of the Cieno soil—

Drainage class: Poorly drained
Permeability: Very slow
Available water capacity: High
Surface runoff: Ponded
Root zone: Deep
Hazard of water erosion: Slight
Water table: Perched within a depth of 1.0 foot above the surface to 1.5 feet below the surface during winter and spring; water may be above the surface for several days
Shrink-swell potential: Moderate

Included in mapping are small areas of Telferner, Inez, Morales, and Fordtran soils. Also included are areas that are similar to the Nada soil but have a texture of sandy clay below a depth of 40 inches.

The Nada and Cieno soils are used as cropland, rangeland, or pasture. Most of the acreage is in rice fields. Some areas of the Cieno soil are excavated for small ponds that are used as livestock water, irrigation reservoirs, and wildlife habitat.

These soils are well suited to the production of crops such as rice. Land leveling is necessary if the soils are irrigated. Good management practices include leaving crop residue on the surface. Incorporating crop residue into the soil helps to maintain favorable soil structure and tilth and increases the rate of water intake. Fertilizer is needed for maximum crop production. These soils also are well suited to improved pasture grasses, such as coastal bermudagrass and bahiagrass. The rangeland vegetation consists of open prairie plants, including paspalums and bluestems.

The Nada soil has many limitations affecting most urban and recreational uses. The main limitations are the wetness, inadequate drainage, the very slow permeability, and corrosivity. The Cieno soil is poorly suited to most uses because of the ponding. The high water table and the very slow permeability of both soils can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of these soils.

These soils provide good habitat for dove, quail, deer, and other types of wildlife. Several thousand geese and ducks migrate to this area in the winter.

The capability unit is IIIw. The Nada soil is in the Claypan Prairie range site and the Cieno soil in the Lowland range site.

Nc—Navaca clay, frequently flooded. This very deep, nearly level soil is on flood plains along rivers and large creeks. Individual areas are long and narrow. They range from a few hundred feet to a few hundred yards wide and are as much as several miles long. They often have an undulating appearance because of scouring and deposition, which leave both elongated mounds and small depressions parallel to the stream channels. The small mounds consist of loamy and sandy alluvial sediments. Individual areas range from 20 to 300 acres in size and average about 100 acres. Slopes are generally less than 2 percent.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 31 inches; dark gray, moderately alkaline clay

Underlying material:
31 to 45 inches; brown, moderately alkaline fine sandy loam
45 to 80 inches; light yellowish brown, moderately alkaline loamy fine sand

Important soil properties—

Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: Moderate or high
Surface runoff: Slow
Root zone: Deep
Hazard of water erosion: Slight
Water table: Apparent within a depth of 2.5 to 5.0 feet in winter and spring
Hazard of flooding: At least once every 2 years and in some areas 2 to 4 times each year
Shrink-swell potential: Moderate in the surface layer

Included with this soil in mapping are small areas of Bleiblerville, Branyon, Navidad, and Pursley soils. Bleiblerville and Branyon soils are on the slightly convex surfaces at slightly higher elevations. Navidad soils are on small, elongated mounds. Pursley soils have a loamy surface layer. Also included are some areas of Navaca soils that are clay loam in the upper 10 inches. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for rangeland or wildlife habitat because of the hazard of flooding (fig. 13). Most areas are so narrow that use as pasture is limited.

Figure 13.—An area of Navaca clay, frequently flooded, in the foreground and an area of Navidad fine sandy loam, occasionally flooded, 1 to 3 percent slopes, in the background. These soils provide excellent food and cover for wildlife.

There are a few pastures of either common bermudagrass or coastal bermudagrass.

This soil has excellent potential for pecan tree production. Pecan trees are common. In addition to native pecan trees, many improved varieties of pecans have been grafted by local landowners. Management practices include spraying trees for insects, managing understory vegetation, and applying fertilizer annually.

This soil is not suitable for most urban uses because of the hazard of flooding. Recreational areas are primarily limited to hunting and fishing.

In addition to the large pecan trees, there are many other varieties of trees and some invading brush. This vegetation provides excellent habitat for coyote, deer, rabbits, squirrels, and wild hogs. Nesting areas for quail, dove, and songbirds are plentiful. In the winter,

ducks and geese that migrate to south Texas sometimes alternate between the rice fields and grain fields and the wooded bottom land.

The capability subclass is Vw; Clayey Bottomland range site.

NvB—Navidad fine sandy loam, occasionally flooded, 1 to 3 percent slopes. This very deep, gently sloping soil is on flood plains and low terraces along rivers and large creeks. Individual areas are long and narrow. They range from a few hundred feet to a few hundred yards wide and are as much as a mile long. They generally have a distinct undulating appearance because of scouring and deposition, which leave elongated mounds of loamy and sandy sediments parallel to the stream channels. Individual areas range from 20 to 200 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 38 inches; dark grayish brown, neutral very fine sandy loam

Underlying material:
38 to 55 inches; pale brown, neutral sandy loam
55 to 80 inches; brown, neutral sandy loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: Moderate
Surface runoff: Slow or medium
Root zone: Deep
Hazard of water erosion: Slight
Hazard of flooding: At least once every 2 to 5 years
Shrink-swell potential: Low

Included with this soil in mapping are small areas of Branyon, Navaca, and Pursley soils. Branyon and Navaca soils are clayey. Branyon soils are on the slightly convex upland slopes, and Navaca soils are in small, elongated depressions. Pursley soils are loamy. They are nearly level and frequently flooded. Also included are some areas of Navidad soils that have a clayey texture in the upper 10 inches. The included soils make up less than 20 percent of the map unit.

The Navidad soil is used mainly as rangeland or wildlife habitat because of the hazard of flooding. Most areas are so narrow that use as pasture is limited. There are a few pastures of common bermudagrass or coastal bermudagrass.

This soil has potential for pecan tree production. In addition to native pecan trees, several improved varieties of pecans have been grafted by local landowners. Management practices include spraying trees for insects and annually applying fertilizer.

This soil is not suitable for most urban uses because of the hazard of flooding. Recreational uses are primarily limited to hunting.

In addition to the large pecan trees, there are many other varieties of trees and some invading brush. This vegetation provides excellent habitat for coyote, deer, rabbits, squirrels, and wild hogs. Nesting areas for quail, dove, and songbirds are plentiful. In the winter, many ducks and geese migrate to this part of south Texas. Their feeding and resting areas include rice fields and grain fields near wooded bottom land.

The capability subclass is IIw; Loamy Bottomland range site.

Pe—Pulexas fine sandy loam, frequently flooded. This very deep, nearly level soil is on flood plains along a few creeks that drain sandy soils. Individual areas are long and narrow. They range from 100 feet to a few hundred yards wide and are as much as a few miles long. They range from 20 to 150 acres in size and average about 50 acres. Slopes are generally less than 1 percent.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 17 inches; brown, neutral fine sandy loam

Underlying material:
17 to 46 inches; pale brown, moderately alkaline fine sandy loam
46 to 68 inches; pale brown, moderately alkaline loamy fine sand
68 to 80 inches; pale brown, moderately alkaline fine sand

Important soil properties—

Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: Low
Surface runoff: Slow
Root zone: Deep
Hazard of water erosion: Slight
Hazard of flooding: At least once every 2 years and in many areas 2 to 4 times each year
Shrink-swell potential: Low

Included with this soil in mapping are small areas of Catilla, Kuy, Navidad, and Pursley soils. Catilla and Kuy soils are sandy. They are on the slightly convex slopes

at slightly higher elevations. Navidad soils are darker than the Pulexas soil. They are on small, elongated mounds. The nearly level Pursley soils have a darker surface layer than the Pulexas soil and are more clayey throughout. The included soils make up less than 15 percent of the map unit.

The Pulexas soil is used mainly as rangeland or wildlife habitat because of the hazard of flooding. Most areas are so narrow that use as pasture is limited. There are a few pastures of either common bermudagrass or coastal bermudagrass.

Native pecan trees grow very well in areas of this soil. Improved varieties of pecans have been grafted to many of the native trees by local landowners. Management practices include spraying trees for insects, managing understory vegetation, and annually applying fertilizer.

This soil is not suitable for most urban uses because of the hazard of flooding. Recreational uses are primarily limited to hunting.

In addition to the large pecan trees, there are many other varieties of trees and some invading brush. This vegetation provides excellent habitat for coyote, deer, rabbits, squirrels, and wild hogs. Nesting areas for quail, dove, and songbirds are plentiful. In the winter, ducks and geese that migrate to south Texas sometimes alternate between the rice fields and grain fields and the wooded bottom land.

The capability subclass is Vw; Loamy Bottomland range site.

Pu—Pursley loam, frequently flooded. This very deep, nearly level soil is on flood plains along rivers and large creeks. Individual areas are long and narrow. They range from 100 feet to a few hundred yards wide and are as much as a few miles long. They range from 50 to 300 acres in size and average about 100 acres. Slopes are generally less than 1 percent.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:

0 to 16 inches; dark grayish brown, moderately alkaline loam

Underlying material:

16 to 29 inches; light brownish gray, moderately alkaline loam

29 to 57 inches; pale brown, moderately alkaline fine sandy loam

57 to 62 inches; very pale brown, moderately alkaline loamy fine sand

62 to 80 inches; light gray, moderately alkaline sandy loam

Important soil properties—

Drainage class: Well drained
Permeability: Moderate
Available water capacity: High
Surface runoff: Slow
Root zone: Deep
Hazard of water erosion: Slight
Hazard of flooding: At least once every 2 years and in many areas 2 to 4 times a year
Shrink-swell potential: Moderate

Included with this soil in mapping are small areas of Branyon, Navaca, and Navidad soils. Branyon soils are clayey. They are on the slightly convex upland slopes. Navaca soils have a clayey surface layer. Navidad soils are on small, elongated mounds. Also included are some soils that have a surface layer of loamy fine sand and a subsoil that is coarse loamy. The included soils make up less than 20 percent of the map unit.

The Pursley soil is used mainly as rangeland or wildlife habitat because of the hazard of flooding. Most areas are so narrow that use as pasture is limited. There are a few pastures of either common bermudagrass or coastal bermudagrass.

This soil has excellent potential for pecan tree production. Pecan trees are common. In addition to native pecan trees, many varieties of improved pecans have been grafted by local landowners. Management practices include spraying trees for insects and annually applying fertilizer.

This soil is not suitable for most urban uses because of the hazard of flooding. Recreational uses are primarily limited to hunting.

In addition to the large pecan trees, there are many other varieties of trees and some invading brush. This vegetation provides excellent habitat for coyote, deer, rabbits, squirrels, and wild hogs. Nesting areas for quail, dove, and songbirds are plentiful. In the winter, ducks and geese that migrate to south Texas sometimes alternate between the rice fields and grain fields and the wooded bottom land.

The capability subclass is Vw; Loamy Bottomland range site.

StC—Straber loamy sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on broad convex slopes, low ridges, and upland divides. Slopes are mostly convex, but some areas are plane or slightly concave. Individual areas are oval or irregular in shape. They range from 20 to more than 500 acres in size and average about 200 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 7 inches; brown, medium acid loamy sand

Subsurface layer:
7 to 14 inches; very pale brown, neutral loamy sand

Subsoil:
14 to 23 inches; brownish yellow, strongly acid clay that is mottled in shades of red, yellow, or brown
23 to 34 inches; reddish yellow, strongly acid sandy clay that is mottled in shades of red, yellow, or brown
34 to 52 inches; light gray, strongly acid sandy clay that is mottled in shades of red, yellow, or brown
52 to 62 inches; light gray, slightly acid sandy clay loam that is mottled in shades of red, yellow, or brown

Substratum:
62 to 80 inches; light gray, slightly acid sandy clay loam that is mottled in shades of red, yellow, or brown

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: Moderate
Surface runoff: Slow or medium
Root zone: Deep, but the dense subsoil restricts root penetration
Hazard of wind erosion: Moderate
Hazard of water erosion: Moderate
Water table: Apparent within a depth of 1.5 to 2.5 feet during rainy periods
Shrink-swell potential: High in the upper part of the subsoil and moderate in the lower part

Included with this soil in mapping are small areas of Catilla, Denhawken, Dubina, Elmendorf, Hallettsville, and Tremona soils. Catilla and Tremona soils are on sandy, slightly undulating slopes. Denhawken and Elmendorf soils are mapped in a complex on small clayey ridges. Catilla, Denhawken, Elmendorf, and Tremona soils are in landscape positions similar to those of the Straber soil. Dubina and Hallettsville soils are in the lower landscape positions. Also included are narrow gullies as much as 10 feet deep. Inclusions make up less than 20 percent of the map unit.

The Straber soil is used as pasture, rangeland, or cropland. Forage and crop yields are low or medium, depending on management practices.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Bahiagrass is planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum pasture and hay production.

The rangeland vegetation includes bluestems, paspalums, and panicums and thick stands of post oak trees. Yaupon is common in overgrazed areas. The rangeland produces medium yields if good management practices, such as deferred grazing, are applied.

The areas used as cropland are minor in extent. The main crops are corn and grain sorghum. Some areas are planted to either forage sorghum or small grain. Good management practices include leaving crop residue on the surface, growing cover crops, farming on the contour, terracing, and establishing grassed waterways. These practices help to maintain productivity and tilth and to control wind erosion and water erosion. Applications of fertilizer, including nitrogen, phosphate, and potash, increase crop yields and should be applied based on laboratory test results.

This soil is suitable for most kinds of urban and recreational uses but has some limitations. These limitations include the shrink-swell potential, the very slow permeability, and corrosivity. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. This soil does not provide an ideal surface for camp areas or for other recreational uses. Soil blowing can be a nuisance in recreational areas where the surface is not adequately protected. A vegetative cover can reduce the hazards of wind erosion and water erosion.

This soil produces good stands of post oak and other trees and various grasses. The heavily wooded vegetation provides excellent habitat for deer. The leasing of land for deer hunting is common in areas of this soil. This soil also provides excellent habitat for armadillo, dove, quail, raccoons, songbirds, and squirrels.

The capability subclass is IIIe; Sandy Loam range site.

StD4—Straber-Gullied land complex, 2 to 8 percent slopes. These soils are most common in areas where old fields are adjacent to creeks and their tributaries. The Straber soil has highly erosive parent material. This material consists of sands and clays that are highly

susceptible to water erosion. In many areas erosion is related to past farming practices, but in some areas extensive geologic erosion has occurred.

Straber soils make up about 57 percent of the total acreage and 45 to 60 percent of individual areas. Gullies make up about 42 percent of the total acreage and 40 to 45 percent of individual areas. The gullies range from 3 to 20 feet deep, but most are 5 to 10 feet deep. They range from a few hundred feet to more than a mile long. Sheet erosion is common, and 30 to 100 percent of the original surface soil has been eroded. Individual areas are irregular in shape and are parallel to creeks, drains, and old fields. They range from 10 to more than 200 acres in size and average about 50 acres.

The typical sequence, depth, and composition of layers of the Straber soil are—

Surface layer:
0 to 3 inches; yellowish brown, medium acid loamy sand

Subsoil:
3 to 51 inches; strongly acid sandy clay that is yellow in the upper part and very pale brown in the lower part

Substratum:
51 to 80 inches; light gray, medium acid sandy clay with strata of sandy clay loam

Important properties of the Straber soil—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: Low
Surface runoff: Rapid
Root zone: Deep, but the dense subsoil restricts root penetration
Hazard of water erosion: Severe
Water table: Apparent within a depth of 1.5 to 2.5 feet for brief periods
Shrink-swell potential: High in the upper part of the subsoil and moderate in the lower part

Included are small eroded areas of Denhawken, Dubina, Elmendorf, Hallettsville, and Tremona soils. These soils are exposed along the sides of gullies. Denhawken and Elmendorf soils generally are higher in elevation, and Tremona, Dubina, and Hallettsville soils are lower. The included soils make up less than 20 percent of the map unit.

This unit is used mainly for rangeland or wildlife habitat. Forage production is low. Areas of this unit should be mechanically reshaped to help control erosion. The construction of stock ponds and revegetation can also help to control erosion. Fencing the gullied soil is necessary to prevent overgrazing and further erosion.

This unit has severe limitations for many urban uses but only minor limitations for recreational uses. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. The very slow permeability may cause failure of septic tank absorption systems, especially during prolonged wet periods. Extra large absorption fields or specially designed absorption systems may be needed. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of the Straber soil. Soil blowing can be a nuisance in recreational areas where the surface is not adequately protected. A vegetative cover can reduce the hazards of wind erosion and water erosion.

This unit and adjacent wooded areas provide fair habitat for deer, dove, quail, and other wildlife.

The capability subclass is VIe; Sandy Loam range site.

TeA—Telferner fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil is on uplands. It is in the extreme southern and southeastern parts of the county. Individual areas are oval or irregular in shape. They range from 20 to more than 400 acres in size and average about 50 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 14 inches; light brownish gray, neutral fine sandy loam

Subsoil:
14 to 19 inches; grayish brown, slightly acid sandy clay that has yellowish red mottles
19 to 46 inches; light brownish gray sandy clay that has brownish yellow mottles and ranges from slightly acid in the upper part to moderately alkaline in the lower part
46 to 70 inches; light gray, moderately alkaline sandy clay loam

Substratum:
70 to 80 inches; white, moderately alkaline clay loam

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow

Available water capacity: High
Surface runoff: Slow
Root zone: Deep
Hazard of wind erosion: Slight
Hazard of water erosion: Slight
Water table: Perched within a depth of 2 feet during rainy periods
Shrink-swell potential: High in the upper part of the subsoil and moderate in the lower part

Included in mapping are small areas of Cieno, Dacosta, Edna, Fordtran, and Nada soils. Cieno soils are in small rounded depressions. Dacosta, Edna, Fordtran, and Nada soils are in landscape positions that are slightly lower than or similar to those of the Telferner soil. The included soils make up less than 15 percent of the map unit.

The Telferner soil is used mainly as rangeland. A few areas are used as cropland or improved pasture.

The rangeland consists of open prairie plants, including invading scrub live oak. Forage yields are medium or high. Good management practices include deferred grazing, especially during periods of extensive drought.

This soil is moderately suited to cropland. The main crops are rice, corn, and grain sorghum. The low natural fertility level and the droughtiness limit production. Runoff is slow in large, nearly level areas. The slow runoff results in excess surface water. Good management practices include leaving crop residue on the surface, applying a system of timely and limited tillage, and rotating crops. Fertilizer is needed for maximum crop production and should be applied based on laboratory test results. Drainage ditches are beneficial where adequate outlets are available.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Bahiagrass, kleingrass, or bluestems are planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum hay and pasture production.

This soil has some limitations affecting most urban and recreational uses. The main limitations are the perched seasonal high water table, inadequate drainage, the very slow permeability, corrosivity, and the shrink-swell potential. The very slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil.

This soil provides good habitat for deer, dove, and quail, as well as migratory geese and ducks.

The capability subclass is IIIw; Loamy Prairie range site.

TrC—Tremona loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on broad convex slopes, low ridges, and upland divides. Slopes are mainly convex, but some areas are plane or slightly undulating. Individual areas are oval or irregular in shape. They range from 20 to more than 1,000 acres in size and average about 300 acres.

The typical sequence, depth, and composition of the layers of this soil are—

Surface layer:
0 to 7 inches; light brownish gray, slightly acid loamy fine sand

Subsurface layer:
7 to 27 inches; very pale brown, slightly acid loamy fine sand

Subsoil:
27 to 61 inches; light gray, strongly acid sandy clay that has reddish yellow and dusky red mottles
61 to 80 inches; light gray, strongly acid sandy clay loam that has reddish yellow and dusky red mottles

Important soil properties—

Drainage class: Somewhat poorly drained
Permeability: Very slow
Available water capacity: Moderate
Surface runoff: Slow
Root zone: Deep
Hazard of wind erosion: Moderate
Hazard of water erosion: Moderate
Water table: Perched within a depth of 1.5 to 3.5 feet during rainy periods
Shrink-swell potential: High in the subsoil

Included with this soil in mapping are small areas of Catilla, Denhawken, Dutek, Elmendorf, and Straber soils. Catilla soils are deep and sandy. They are on the

lower elevations and are mainly parallel to streams. Denhawken and Elmendorf soils are mapped in a complex on the small clayey ridges. Dutek soils are on ancient terraces near large streams. Straber soils are less sandy than the Tremona soil and are in nearly level areas. Also included are narrow gullies as much as 10 feet deep. Inclusions make up less than 20 percent of the map unit.

The Tremona soil is used mainly as pasture or rangeland. A few areas are used as cropland. Forage and crop yields are low or medium, depending on management practices.

Improved pasture grasses are mainly coastal bermudagrass and other bermudagrasses. Bahiagrass is planted in some areas. Applications of fertilizer, especially nitrogen, and rotation grazing are needed for maximum pasture and hay production.

The rangeland vegetation includes bluestems, paspalums, and panicums and thick stands of post oak trees and invading yaupon. The rangeland produces medium yields if good management practices, such as deferred grazing, are applied.

Small areas of cropland are planted mainly to forage sorghum or small grain. Good management practices include leaving crop residue on the surface, growing cover crops, farming on the contour, and establishing grassed waterways. These practices help to maintain the productivity and tilth of the soil and to control wind erosion and water erosion. Applications of fertilizer, including nitrogen, phosphate, and potash, increase crop yields and should be applied based on laboratory test results.

This soil has limitations affecting some urban and recreational uses. The major limitations are the perched seasonal high water table, the very slow permeability, the sandy surface layer, the shrink-swell potential, and corrosivity. The very slow permeability and the high water table can cause failure of conventional septic tank absorption systems, especially during prolonged wet periods. Specially designed absorption systems may be needed. The high water table is a limitation affecting the construction of buildings with basements and may interfere with the construction of other underground structures. In some areas the wetness can be reduced by open drainage ditches or an underground drainage system. The shrink-swell potential can cause cracking of building foundations, brick walls, road surfaces, sidewalks, and pipelines. Adding sand or other nonexpansive material can minimize the structural damage caused by shrinking and swelling. Special treatment is necessary to increase the stability of road subgrades. Foundations generally require extra reinforcement. Pipelines, storage tanks, and other underground structures made of steel should be protected from the unusually high corrosion potential of this soil. This soil does not provide an ideal surface for camp areas or for other recreational uses. Soil blowing can be a nuisance in recreational areas where the surface is not adequately protected. A vegetative cover can reduce the hazards of wind erosion and water erosion.

This soil produces good stands of post oak and other trees and various grasses. This heavily wooded vegetation provides excellent habitat for deer. The leasing of land for deer hunting is common in areas of this soil. This soil also provides excellent habitat for armadillo, dove, quail, raccoons, songbirds, and squirrels.

The capability subclass is IIIe; Sandy range site.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. The moisture supply must be adequate, and the growing season must be sufficiently long. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They are used for food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 5 percent.

About 35 percent of the soils in Lavaca County are prime farmland. These soils are mostly in general soil map units 2, 3, and 4. The map units that are considered prime farmland in Lavaca County are listed in table 5. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

James Alderson, range conservationist, Soil Conservation Service, Victoria, Texas, helped to prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1985, about 290,000 acres in Lavaca County was used for crops or pasture. Of this total, 61,000 acres was used for crops. About 38 percent of this acreage was in irrigated rice.

Soil erosion is the major problem on nearly all of the cropland where slopes are more than 2 percent. Loss of the surface layer through erosion is damaging. Productivity is reduced as the original surface layer is lost and part of the subsoil is incorporated into the plow layer. Soil erosion on farmland also results in sediment entering streams. Where erosion is controlled, the pollution of streams by sediment is minimized and the quality of water for municipal use, for recreation, and for fish and wildlife is improved.

Crop residue management helps to control erosion. Leaving crop residue on the surface helps to protect against packing rains, minimizes surface crusting, helps to control runoff, reduces the rate at which soil moisture evaporates, improves tilth, and minimizes compaction by farm machinery. Crop residue should be protected from overgrazing and burning. Tillage equipment that leaves crop residue on the surface should be used. Conservation tillage is effective in reducing erosion on sloping land and can be adapted to most of the soils that are now being cropped.

Contour terraces reduce the length of the slope and thus help to control runoff and erosion. They are most practical on deep and moderately deep, clayey and loamy soils that have slopes of more than 1 percent.

Grain sorghum and corn are commonly grown field crops that are suited to the soils and climate of the

Figure 14.—Native grasses growing in an area of Frelsburg clay, 1 to 3 percent slopes.

county. Wheat, oats, legumes, and forage sorghum are the main close-growing crops. Irrigated rice also is grown. Kleingrass and Gordo, Medio, and King Ranch bluestems are suitable for producing grass seed.

Pasture is important in the county because raising livestock is the main farm enterprise. For the past several years, the trend has been to convert land from other uses to pasture or hay. Land used for pasture or hay generally is planted to introduced grasses or native grasses that respond to good management (fig. 14). These grasses are mainly used to provide year-round grazing in combination with native range.

Among the important grasses are coastal and Alicia bermudagrasses, kleingrass, Gordo and Angleton bluestems, Alamo switchgrass, and bahiagrass. With the exception of the bluestems and bahiagrass, all of these species are adapted to most of the soils in the county. Coastal bermudagrass is the best suited of

these grasses to the coarse and moderately coarse textured soils on uplands. Alamo switchgrass also is suited to these soils. Bahiagrass does well on the coarse textured soils if the surface layer has pH of 5 or 6. Gordo bluestem is best adapted to the fine textured, deep soils. Alamo switchgrass and Angleton bluestem are well adapted to the poorly drained, nearly level soils. A good, firm weed-free seedbed should be prepared, and the grasses should be planted or sprigged at optimum dates and rates.

Good management practices for pasture include fertilization, rotation grazing to maintain the proper grazing height, and weed and brush management. Good management practices for hay include fertilizing and cutting forage at the correct height and at the proper stage of growth.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(23)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode, but they have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly

because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class I because the soils of this class have few limitations. The soils in class V are subject to little or no erosion, but they have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation. Class V contains only the subclasses indicated by *w, s,* or *c.*

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Rangeland

James Alderson, range conservationist, Soil Conservation Service, Victoria, Texas, prepared this section.

Rangeland occurs as areas where the native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. The vegetation generally is suitable for grazing by domestic livestock and native wildlife. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition and production of the plant community are determined by the soil, climate, topography, overstory canopy, and grazing management.

About 51 percent, or approximately 317,000 acres, of the county is rangeland. From 1800 to about 1880, the rangeland consisted of large ranches. Between 1880 and 1890, the open ranges were fenced in and the size of ranches greatly decreased. Historically, the rangeland has been used mostly for beef cattle production; however, from 1870 to 1890, raising sheep was an important enterprise. The introduction of cultivated pastures has complemented the rangeland, and beef production is still the most important agricultural industry in the county. In 1985, the county was ranked fourth in the state in terms of number of beef cows *(20).*

The plant communities in Lavaca County have changed drastically over the past 140 years. Originally, most of the county was a savannah of mid and tall grasses interspersed with a less than 20 percent canopy of scattered, large trees. The northern third of the county and a small area in the southeast corner were treeless prairies, which consisted of a wide variety of mid and tall grasses interspersed with an abundance of forbs. Continuous heavy grazing for many years has resulted in deterioration and depletion of the plant communities. Most of the high-producing, high-quality vegetation has been grazed out. These higher quality plants are now found only in a few places. In most areas the higher quality plants have been replaced by a mixture of lower quality grasses, forbs, and brush. In areas where remnants of the higher quality plants still occur, good grazing management will allow these plants to reestablish themselves.

Approximately 32 percent of the total annual rainfall occurs in April, May, and June. It contributes to approximately 70 percent of the annual growth of warm-season plants by early July. A midsummer growth slump occurs in July and August because of lower amounts of rainfall and higher temperatures. A secondary growth period occurs in September, October, and early November when autumn rains and somewhat cooler temperatures are common. However, this production period is limited because of increasingly cooler temperatures and shorter days.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship of the soils, vegetation, and water.

Table 7 shows, for each soil, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, or proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the climax plant community. Total production includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants, but it does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry

moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management requires a knowledge of the kinds of soil and of the potential climax plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the climax plant community on a particular range site. The more closely the existing community resembles the climax community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential climax plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Range Sites and Condition Classes

Soils that produce about the same kinds and amounts of climax vegetation for forage make up a range site. The soil properties that affect the moisture supply and plant nutrients have the most influence on productivity.

The climax vegetation on a range site is the stabilized plant community that reproduces and maintains itself with very little change as long as the environment remains unchanged. The most palatable and productive combination of forage plants on a range site is generally the climax vegetation.

Three kinds of plants can be identified on a site that has deteriorated because of grazing pressure. These are decreasers, increasers, and invaders.

Decreasers are plants in the climax vegetation that tend to decrease under close grazing. They are generally the tallest, most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter and produce less forage than decreasers. They are generally less palatable to livestock.

Invaders are plants that cannot compete with the plants in the climax plant community for moisture, nutrients, and light. After the climax vegetation has been reduced by continued, close grazing, they invade and grow along with the increasers.

Range condition is judged according to standards that apply to the particular range site. Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other factors. The classes show the present condition of the native plant community as compared to the potential native plant community. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand, in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

The county has 17 range sites. These are Blackland (Blackland Prairie), Blackland (Coast Prairie), Clay Loam, Clayey Bottomland, Claypan Prairie, Claypan Savannah, Deep Sand, Deep Sand Savannah, Eroded Blackland, Loamy Bottomland, Loamy Prairie, Lowland, Rolling Blackland, Salty Prairie, Sandy, Sandy Loam, and Sandy Prairie.

Blackland (Blackland Prairie) range site. The Bleiblerville, Branyon, Frelsburg, and Greenvine soils in map units BbB, BrA, FsB, FsC, FsD, GrB, and GrC are in this range site. The climax vegetation is a true prairie. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

About 75 percent of the climax community is little bluestem and indiangrass. The other grasses are switchgrass, brownseed paspalum, Virginia wildrye, Texas wintergrass, longtom, and meadow dropseed. Forbs include sensitive briar, Maximilian sunflower, bundleflower, and dotted gayfeather.

Under heavy grazing, little bluestem, indiangrass, switchgrass, and Maximilian sunflower are replaced by brownseed paspalum and meadow dropseed. If heavy grazing continues for many years, woody plants, such as huisache, baccharis, Macartney rose, and sennabean, significantly increase in abundance.

Blackland (Coast Prairie) range site. The Dacosta and Lake Charles soils in map units DaA and LaA are in this range site. The climax vegetation is a tall grass prairie. The composition is about 95 percent grasses and 5 percent forbs.

About 75 percent of the climax community is little bluestem, indiangrass, eastern gamagrass, switchgrass, and big bluestem. Other grasses include vaseygrass and Florida paspalum. The rest of the plant community consists of forbs, such as Maximilian sunflower, gayfeather, prairie-clover, sensitive briar, and blackeyed Susan.

Under heavy grazing, the tall grasses, such as indiangrass, eastern gamagrass, and big bluestem,

decrease in abundance. They are replaced initially by silver bluestem, knotroot bristlegrass, and a higher proportion of little bluestem. If overgrazing continues, the site is dominated by broomsedge bluestem, smutgrass, brownseed paspalum, annual weeds and grasses, and woody plants, such as eastern baccharis, sesbania, mesquite, and huisache.

Clay Loam range site. The Carbengle, Cuero, and Flatonia soils in map units CaB, CaC, CaC3, CaD, CuB, and FnB are in this range site. The climax vegetation is a tall grass prairie with some woody plants along drainageways. The composition is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

About 70 percent of the climax community is little bluestem, indiangrass, switchgrass, and big bluestem. Other grasses include Florida paspalum, Canada wildrye, sideoats grama, silver bluestem, tall dropseed, Texas wintergrass, and buffalograss. Forbs include Maximilian sunflower, Engelmann daisy, black Samson, bundleflower, sensitive briar, yellow neptunia, prairie-clover, snoutbean, tickclover, partridge pea, and vetch. Woody vegetation includes hackberry, elm, and pecan mostly along drainageways and widely scattered live oak in the uplands.

Under heavy grazing, big bluestem is grazed out first, followed by indiangrass, switchgrass, and little bluestem. As these grasses decrease in abundance, sideoats grama, silver bluestem, Texas wintergrass, tall dropseed, and low panicums initially increase in abundance and then decrease in abundance as overgrazing continues. Eventually, the vegetation remaining consists mainly of buffalograss, Texas grama, western ragweed, nightshades, threeawns, milkweed, and mesquite.

Clayey Bottomland range site. The Navaca soil in map unit Nc is in this range site. The climax vegetation is a savannah. The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

About 50 percent of the climax community is Virginia wildrye, Canada wildrye, sedges, switchgrass, indiangrass, little bluestem, big bluestem, eastern gamagrass, vine-mesquite, Florida paspalum, and panicums. Woody plants include elm, cottonwood, hackberry, pecan, willow, and oak. Forbs include tickclover, snoutbean, lespedeza, blood ragweed, and ironweed.

If the site is overgrazed, trees and shrubs increase in abundance to form a dense canopy and shade-sensitive prairie grasses decrease in abundance. If heavy grazing continues, tall grasses are grazed out and are replaced by broomsedge bluestem, smutgrass, carpetgrass, bermudagrass, buffalograss, cocklebur, ragweed, annual grasses, and forbs.

Claypan Prairie range site. The Edna and Nada soils in map units EdA and NaA are in this range site (fig. 15). The climax vegetation is a prairie. The composition is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

About 65 percent of the climax community is little bluestem and indiangrass. Other grasses include switchgrass, big bluestem, Virginia wildrye, Canada wildrye, Florida paspalum, sideoats grama, meadow dropseed, Texas wintergrass, vine-mesquite, purpletop, brownseed paspalum, buffalograss, low panicums, and sedges. Forbs include Maximilian sunflower, Engelmann daisy, halfshrub sundrop, black Samson, sensitive briar, yellow neptunia, bundleflower, vetch, snoutbean, Indian paintbrush, milkweed, and western ragweed. Woody plants include oak, elm, hackberry, and coralberry.

Under heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance. These grasses are replaced by silver bluestem, meadow dropseed, Texas wintergrass, and sideoats grama. If overgrazing continues, the site is dominated by mesquite, buffalograss, Texas grama, pricklypear, Texas wintergrass, windmillgrass, and weedy forbs. Some areas have been invaded by post oak, yaupon, greenbriar, and other woody plants.

Claypan Savannah range site. The Falba and Hallettsville soils in map units FbB and HaB are in this range site. The climax vegetation is a savannah of post oak and blackjack oak. The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

About 60 percent of the climax community is little bluestem, indiangrass, and brownseed paspalum. Other grasses include switchgrass, Florida paspalum, purpletop, low panicums, threeawns, sideoats grama, silver bluestem, Texas wintergrass, and sedges. Woody plants include post oak, blackjack oak, hackberry, elm, hawthorn, yaupon, and other woody shrubs. Forbs include bundleflower, lespedeza, sensitive briar, Engelmann daisy, western ragweed, and croton.

Under heavy grazing, little bluestem and indiangrass are grazed out and brownseed paspalum, silver bluestem, splitbeard bluestem, Texas wintergrass, and low panicums increase in abundance. If heavy grazing continues, oak, elm, yaupon, hawthorn, American beautyberry, eastern redcedar, greenbriar, and berry vines increase in abundance to form a dense canopy. Areas that are more open than others are likely to contain broomsedge bluestem, smutgrass, red

Figure 15.—Typical area of the Claypan Prairie range site on the Nada soil in the Nada-Cieno complex, 0 to 1 percent slopes.

lovegrass, Texas wintergrass, carpetgrass, and a variety of other annual grasses and forbs.

Deep Sand range site. The Kuy soil in map unit KuC is in this range site. The climax vegetation is a prairie. The composition is about 85 percent grasses, 10 percent woody plants, and 5 percent forbs.

About 75 percent of the climax community is little bluestem, indiangrass, and crinkleawn. Other grasses include switchgrass, big bluestem, brownseed paspalum, gulf muhly, slim tridens, and Florida paspalum. Forbs include snoutbean, partridge pea, prairie-clover, croton, bullnettle, and yankeeweed. Woody vegetation is mostly mottes of post oak, live oak, yaupon, and other shrubs.

Under heavy grazing, little bluestem, indiangrass, big bluestem, and switchgrass are grazed out and brownseed paspalum, gulf muhly, and broomsedge bluestem increase in abundance. If heavy grazing continues, the site is dominated by yaupon, bullnettle, yankeeweed, and a variety of other annual weeds and grasses.

Deep Sand Savannah range site. The Catilla soil in map unit CtC is in this range site. The climax vegetation is a savannah. The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

About 60 percent of the climax community is little bluestem and indiangrass. Other grasses include switchgrass, sand lovegrass, crinkleawn, purpletop, brownseed paspalum, silver bluestem, broomsedge bluestem, and low panicums. Woody plants include post oak, blackjack oak, water oak, hickory, American beautyberry, yaupon, greenbriar, berry vines, grape, and elm. Forbs include lespedeza, sensitive briar, western indigo, partridge pea, croton, bullnettle, and yankeeweed.

Under heavy grazing, little bluestem, indiangrass, and switchgrass are grazed out and post oak, blackjack oak, elm, hickory, ash, American beautyberry, and other woody plants increase in abundance. In areas where the range has deteriorated, the vegetation consists mainly of trees interspersed with open areas of broomsedge bluestem, brownseed paspalum, bullnettle, croton, yankeeweed, queen's delight, pricklypear, sandbur, and a variety of other annual grasses and forbs.

Eroded Blackland range site. Greenvine and Latium soils in map units GrD4, LtC3, and LtD4 are in this range site. The potential climax vegetation is a tall grass prairie. The composition is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants. The climax vegetation has been destroyed by cultivation or erosion. As a result, the value of the site has been reduced.

About 75 percent of the climax community is little bluestem, indiangrass, and big bluestem. Other grasses include Virginia wildrye, Canada wildrye, switchgrass, Florida paspalum, sideoats grama, tall dropseed, silver bluestem, Texas wintergrass, and low panicums. Forbs include Maximilian sunflower, Engelmann daisy, black Samson, gayfeather, bundleflower, sensitive briar, vetch, paintbrush, bluebonnet, ragweed, wine-cup, bluebells, milkweed, and croton. Woody vegetation is scattered mottes of live oak, hackberry, elm, and bumelia.

Under heavy grazing, little bluestem, big bluestem, and indiangrass are grazed out and are replaced by silver bluestem, Texas wintergrass, and sideoats grama. If overgrazing continues, the site is dominated by mesquite, winged elm, Texas grama, broomweed, and a variety of other annual grasses and forbs.

Loamy Bottomland range site. Navidad, Pulexas, and Pursley soils in map units NvB, Pe, and Pu are in this range site. The climax vegetation is a savannah. The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

About 50 percent of the climax community is Virginia wildrye, sedges, switchgrass, indiangrass, big bluestem, little bluestem, eastern gamagrass, plumegrass, vine-mesquite, and purpletop. Other grasses include brownseed paspalum, Carolina jointtail, tall dropseed, buffalograss, and Texas wintergrass. Woody plants include oak, pecan, hackberry, elm, cottonwood, willow, sycamore, ash, and woody vines. Forbs include tickclover, lespedeza, snoutbean, partridge pea, blood ragweed, and ironweed.

Under heavy grazing, the taller grasses are grazed out and woody trees, shrubs, and vines increase in abundance to form a dense canopy. If heavy grazing continues, the woody canopy thickens and broomsedge bluestem, bermudagrass, vaseygrass, cocklebur, sunflower, ragweed, and a variety of other annual grasses and forbs grow in open areas.

Loamy Prairie range site. The Telferner soil in map unit TeA is in this range site. The climax vegetation is a true prairie. The composition is about 95 percent grasses and 5 percent forbs.

About 80 percent of the climax community is little bluestem, indiangrass, switchgrass, and eastern gamagrass. Other grasses include Florida paspalum, brownseed paspalum, vaseygrass, fall witchgrass, gulf muhly, and sedges. Forbs include Maximilian sunflower, button snakeroot, gayfeather, sensitive briar, yellow neptunia, bundleflower, ragweed, and prairie-clover.

Under heavy grazing, little bluestem, indiangrass, switchgrass, and eastern gamagrass are grazed out and are replaced by brownseed paspalum, vaseygrass, longspike tridens, fall witchgrass, gulf muhly, and knotroot bristlegrass. If heavy grazing continues, the site is dominated by broomsedge bluestem, windmillgrass, vaseygrass, smutgrass, carpetgrass, yankeeweed, broomweed, wild indigo, and a variety of other annual grasses and weeds.

Lowland range site. The Cieno soil in map units McA and NaA is in this range site. The climax vegetation is a wet prairie (fig. 16). The composition, by weight, is about 95 percent grasses and 5 percent forbs.

About 80 percent of the climax community is switchgrass, indiangrass, Florida paspalum, little bluestem, big bluestem, and eastern gamagrass. The other grasses are brownseed paspalum, knotroot bristlegrass, longtom, sedges, low panicums, low paspalums, broomsedge bluestem, and bushy bluestem. Forbs include sensitive briar, bundleflower, button snakeroot, and Maximilian sunflower.

Figure 16.—Typical area of the Lowland range site on the Cieno soil in the Morales-Cieno complex, 0 to 1 percent slopes. Cieno soils are wet for long periods of time but are capable of producing high-quality grasses for livestock grazing.

Under heavy grazing, switchgrass, indiangrass, eastern gamagrass, little bluestem, big bluestem, and Maximilian sunflower are replaced by longtom, brownseed paspalum, broomsedge bluestem, bushy bluestem, knotroot bristlegrass, sedges, and low panicums. If heavy grazing continues for many years, plants, such as vaseygrass, carpetgrass, smutgrass, common bahiagrass, baccharis, and sennabean, significantly increase in abundance.

Rolling Blackland range site. The Denhawken and Elmendorf soils in map unit DeB are in this range site. The climax vegetation is a true prairie. A few trees grow in mottes and along draws. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

About 70 percent of the climax community is little bluestem, indiangrass, and big bluestem. Other grasses include eastern gamagrass, switchgrass, wildrye, sideoats grama, silver bluestem, Texas wintergrass, tall dropseed, meadow dropseed, fall witchgrass, and buffalograss. Forbs include Maximilian sunflower, Engelmann daisy, gayfeather, bundleflower, sensitive briar, western indigo, snoutbean, and vetch. Woody

plants include live oak, elm, hackberry, and bumelia.

Under heavy grazing, little bluestem, indiangrass, big bluestem, eastern gamagrass, and Maximilian sunflower are replaced by sideoats grama, silver bluestem, wildrye, and forbs, such as bundleflower, wild bean, snoutbean, and fern acacia. Under continuous heavy grazing for many years, buffalograss, Texas wintergrass, ragweed, croton, broomweed, snow-on-the-mountain, and other plants increase in abundance along with a few scattered woody plants, such as bumelia, live oak, elm, and hackberry.

Salty Prairie range site. The Dietrich soil in map unit DhA is in this range site. The climax vegetation is a salty prairie. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

About 75 percent of the climax community is gulf cordgrass. Other grasses are switchgrass, indiangrass, little bluestem, common reed, knotroot bristlegrass, longtom, seashore saltgrass, and shoregrass. Forbs include bushy seaoxeye and tall aster.

Under heavy grazing, bluestem, switchgrass, indiangrass, and common reed are replaced by gulf cordgrass, bermudagrass, red lovegrass, pickleweed, croton, bitter sneezeweed, matrimonyvine, and goldenweed.

Sandy range site. The Dutek, Milby, and Tremona soils in map units DuC, MbB, and TrC are in this range site. The climax vegetation is an open savannah of post oak and blackjack oak, which shade about 25 percent of the ground. The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

About 60 percent of the climax community is little bluestem and indiangrass. Other grasses include witchgrass, beaked panicum, sand lovegrass, crinkleawn, purpletop, brownseed paspalum, purple lovegrass, splitbeard bluestem, and low panicums. Woody species include post oak, blackjack oak, hawthorn, elm, American beautyberry, greenbriar, yaupon, and grape. Forbs include lespedeza, tickclover, sensitive briar, snoutbean, wild bean, western indigo, partridge pea, and yankeeweed.

Under heavy grazing, little bluestem and indiangrass are grazed out and are replaced by sand lovegrass, crinkleawn, brownseed paspalum, broomsedge bluestem, splitbeard bluestem, smutgrass, and low panicums. If heavy grazing continues, oak, greenbriar, yaupon, berry vines, red lovegrass, yankeeweed, bullnettle, croton, broomsedge bluestem, sandbur, pricklypear, queen's delight, smutgrass, and a variety of other annual grasses and weeds increase in abundance.

Sandy Loam range site. The Dubina, Inez, Morales and Straber soils in map units DnB, InB, McA, StC, and StD4 are in this range site. The climax vegetation is a savannah of post oak and blackjack oak (fig. 17). The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

About 60 percent of the climax community is little bluestem and indiangrass. Other grasses include beaked panicum, switchgrass, big bluestem, eastern gamagrass, longleaf uniola, brownseed paspalum, low paspalums, low panicums, silver bluestem, and sedges. Woody plants include post oak, blackjack oak, red oak, hackberry, elm, hawthorn, yaupon, American beautyberry, greenbriar, grape, and berry vines. Forbs include Engelmann daisy, gayfeather, sensitive briar, lespedeza, tickclover, wild bean, snoutbean, partridge pea, ragweed, paintbrush, and evening primrose.

Under heavy grazing, little bluestem, indiangrass, eastern gamagrass, and switchgrass are grazed out and are replaced by silver bluestem, broomsedge bluestem, brownseed paspalum, carpetgrass, and bermudagrass. If heavy grazing continues, oak, elm, hickory, hawthorn, American beautyberry, eastern redcedar, persimmon, yaupon, greenbriar, and berry vines increase in abundance until the site resembles a scrub forest.

Sandy Prairie range site. The Fordtran soil in map unit FrB is in this range site. The climax vegetation is a true prairie. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

About 75 percent of the climax community is little bluestem, indiangrass, crinkleawn, and big bluestem. Other grasses include eastern gamagrass, Florida paspalum, switchgrass, brownseed paspalum, knotroot bristlegrass, low panicums, fringeleaf paspalum, sedges, slender bluestem, and Pan American balsamscale. Forbs include Maximilian sunflower, sensitive briar, bundleflower, and yellow neptunia.

Under heavy grazing, little bluestem, indiangrass, crinkleawn, switchgrass, big bluestem, eastern gamagrass, and Maximilian sunflower are replaced by brownseed paspalum, knotroot bristlegrass, low panicums, slender bluestem, and sedges. If heavy grazing continues for many years, smutgrass, carpetgrass, red lovegrass, broomsedge bluestem, yankeeweed, bitter sneezeweed, and woody plants, such as Macartney rose, huisache, sennabean, and running live oak, significantly increase in abundance.

Figure 17.—Typical area of the Sandy Loam range site on the Morales soil in the Morales-Cieno complex, 0 to 1 percent slopes.

Pecan Orchards

Jerry L. Lackey, county extension agent, Hallettsville, Texas, prepared this section.

The soils in Lavaca County have potential for increased pecan production and thus increased agricultural income. The soils on bottom land have a tremendous potential for pecan production. Healthy native trees with good nut quality should be examined before cutting or bulldozing them down. These native, high-quality trees should be left in production if they can be managed. Several improved pecan varieties also are adapted to Lavaca County. They include the Cheyenne, Choctaw, Desirable, Kiowa, and Shawnee varieties.

Soils on bottom land and stream terraces have the highest potential for pecan production. The bottom land soils include Navaca, Navidad, and Pulexas soils and the Pursley soils that are loam. The soils on the stream

terraces that have a high potential for pecan production are mainly the Dutek soils that are loamy fine sand.

Pecan trees should not be fertilized the first year after transplanting. Beginning with the second year, a nitrogen fertilizer should be applied each year during April, May, and June. The amount of fertilizer applied will depend on the age and size of the trees.

Water is essential for good growth of young trees and regular production of quality nuts on mature, fruit-bearing trees. Drip irrigation, sprinkler irrigation, and flood irrigation can be used. For young trees, small amounts of water should be applied during periods of new growth each spring. As growth continues, temperatures increase, and the days become longer, the amount of water should be increased. Young trees should not be watered in the fall because of the hazard of freezing. The trees may need some water in the winter if a prolonged drought occurs. Mature, fruit-bearing trees need 1 inch of water per week from April to October. They should not go without water for more than 3 weeks during this period.

Pecan scab and stem-end blight are the major diseases affecting pecans in the county. Pecan scab is a fungus that forms lesions on the leaves and shucks. Dark black, sunken spots on the shucks are a typical symptom. During periods of high relative humidity, pecan scab is a very serious problem. Stem-end blight is a fungus that infects the pecan nut at the water stage in late July. It is a serious disease because it occurs in both wet and dry climates. Stem-end blight cannot be identified until after the damage has occurred. The symptoms are black areas on the shuck, a reduction in the size of the kernel, and a tendency of the shuck to stick to the shell.

Insects that affect pecan trees in the county are the pecan nut casebearer, pecan weevils, hickory shuckworms, and black aphids. The pecan nut casebearer is a problem in mid May. The other insects usually appear in August and September.

Pecans cannot be grown successfully in the county without foliar zinc sprays. Soil tests may show that adequate levels of zinc are present; however, the trees cannot absorb the zinc from the soil. The symptoms of zinc rosette are stunted growth, shoots growing in bunches, and dead shoots throughout the top of the older trees. Young trees should be sprayed every 2 weeks from April to August to ensure that growth will continue throughout the season. Trees that are bearing should be sprayed at bud break, prepollination, casebearer, and second-generation casebearer to allow maximum shoot growth and leaf expansion.

Pecans are usually harvested after mid-November. If a major freeze or frost occurs before that date, the shuck can stick to the shell. Pecans grown in residential areas are frequently eaten by squirrels and blue jays. It is not uncommon for a single squirrel to gather 25 pounds of nuts. Most commercial orchards are now harvested with tractor- or truck-mounted shakers. Nuts are then picked up with mechanical harvesters, cleaned in mechanical cleaners, and sacked and sold to wholesalers.

Recreation

In table 8, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Frank Sprague, biologist, Soil Conservation Service, prepared this section.

Wildlife is a valuable resource in Lavaca County. Fishing and hunting are popular year-round sports. Leasing of land for hunting provides an important source of income for many landowners.

Primary wildlife species include white-tailed deer, squirrel, dove, bobwhite quail, and waterfowl. Nongame species include raccoon, rabbit, armadillo, opossum, skunk, bobcat, gray fox, red fox, and a variety of songbirds, wading birds, woodpeckers, predatory birds, reptiles, and amphibians.

The Lavaca and Navidad Rivers, as well as numerous farm ponds and reservoirs, provide habitat for fish. Game species include largemouth bass, channel catfish, flathead catfish, bluegill, redear sunfish, spotted sunfish, warmouth, and crappie. Numerous nongame species, such as bullhead, gar, and carp, are also found in the county.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, grain sorghum, wheat, oats, and rice.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are kleingrass, lovegrass, switchgrass, clover, and bahiagrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil

properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are indiangrass, bluestem, paspalum, panicum, prairie senna, and snoutbean.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are Russian olive, wild plum, mustang grape, and yaupon.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, baccharis, wild millet, saltgrass, longtom, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and coyote.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, egrets, geese, herons, and shore birds.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, prairie chickens, bobwhite quail, turkey, dove, and meadowlark.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet, and because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in

this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. Depth to a high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, depth to a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil

through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant nutrients as it decomposes.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to

overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(3)* and the system adopted by the American Association of State Highway and Transportation Officials *(2)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 20.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The

sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index generally are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 3 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence the shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These

soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year). *Frequent* means that flooding occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons characteristic of soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Physical and Chemical Analyses and Clay Mineralogy of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 17 and the results of chemical analysis in table 18. Clay mineralogy is given in table 19. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas, and by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(25)*.

Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).
Water retained—pressure extraction, percentage of oven-dry weight of less than 2 mm material, ⅓ bar (4B1).
Moist bulk density—of less than 75 mm material, saran-coated clods (4A1).
Linear extensibility—change in clod dimension based on less than 2 mm material (4D).
Organic carbon—dichromate, ferric sulfate titration (6A1c).
Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2), magnesium (6O2), sodium (6P2), potassium (6Q2).
Extractable acidity—barium chloride-triethanolamine IV (6H5a).
Cation-exchange capcacity—ammonium acetate, pH 7.0 (5A8b).
Base saturation—ammonium acetate, pH 7.0 (5A8b).
Reaction (pH)—1:1 water dilution (8C1a).
Reaction (pH)—calcium chloride (8C1e).
Carbonate as calcium carbonate—gas volumetric (6E1g).
Electrical conductivity—saturation extract, digital bridge (8A3a).
Exchangeable sodium percentage (5D).
Mineralogy—x-ray diffraction (7A2).

Engineering Index Test Data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Texas State Department of Highways and Public Transportation, Austin, Texas.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(23)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning dry or burnt, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciustolls (*Calci*, meaning calcic horizon, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Calciustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, carbonatic, thermic Typic Calciustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the substratum within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(22)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(24)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bleiblerville Series

The Bleiblerville series consists of gently sloping, very deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in calcareous, clayey sediments of the Fleming Formation

and Oakville Sandstone. Slope ranges from 1 to 3 percent. The soils are fine, montmorillonitic, thermic Udic Pellusterts.

Typical pedon of Bleiblerville clay, 1 to 3 percent slopes; from Hallettsville, 8.5 miles north on U.S. Highway 77, about 8 miles west on Farm Road 532 to Komensky, 0.7 mile west on Farm Road 532, about 0.23 mile north on a private road, and 100 feet west in a field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and medium granular structure; extremely hard, firm; common fine roots; calcareous; mildly alkaline; clear wavy boundary.

Bw1—6 to 18 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate coarse angular blocky structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; many large intersecting slickensides at a downward angle of about 20 degrees toward microlow; numerous wedge-shaped aggregates; few very fine concretions of calcium carbonate; calcareous; mildly alkaline; gradual wavy boundary.

Bw2—18 to 29 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong coarse angular blocky structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; many large intersecting slickensides at an angle of 10 to 45 degrees (fig. 18); few very fine concretions of calcium carbonate; calcareous; mildly alkaline; gradual wavy boundary.

Bw3—29 to 39 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; few fine distinct light gray (10YR 6/1) mottles; strong coarse angular blocky structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; many large intersecting slickensides at an angle of 10 to 45 degrees; common coarse segregations of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bk—39 to 47 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common medium faint light gray (10YR 6/1) mottles; strong coarse angular blocky structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; many large intersecting slickensides at an angle of 10 to 45 degrees; many coarse segregations of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

BC—47 to 54 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common medium faint light gray (10YR 6/1) mottles; moderate coarse angular blocky structure parting to weak medium angular blocky; extremely hard, very firm; few fine roots; common large intersecting slickensides; few fine segregations of calcium carbonate; few very dark gray (10YR 3/1) streaks along cracks; calcareous; mildly alkaline; clear wavy boundary.

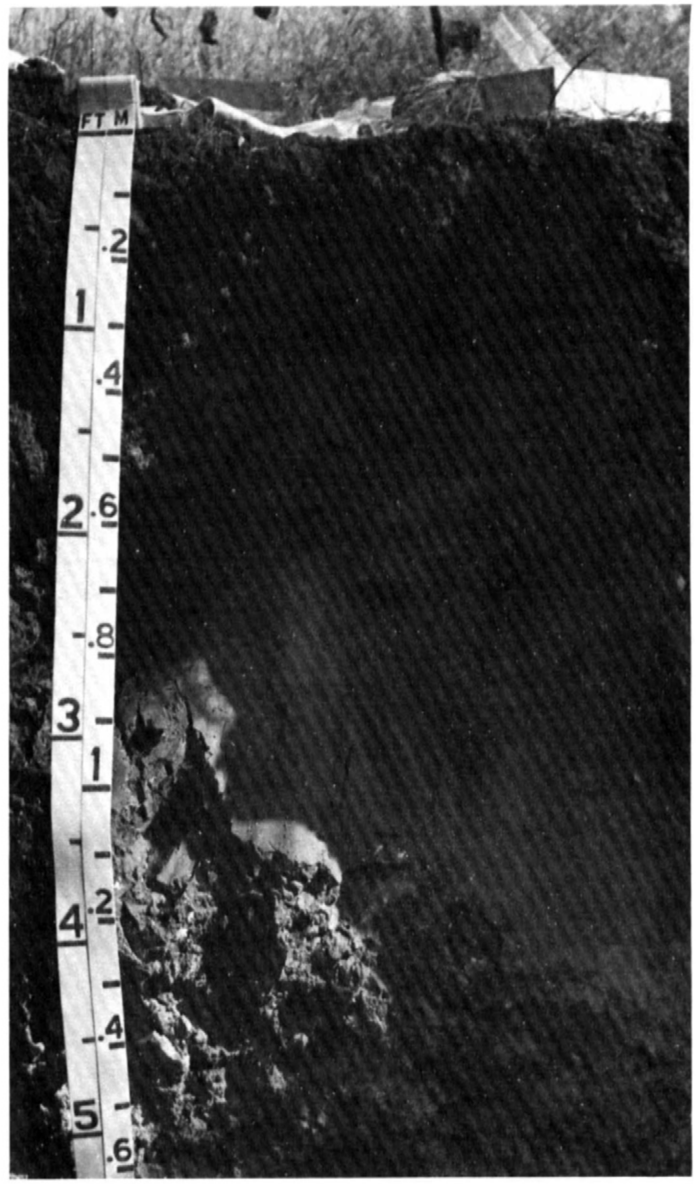

Figure 18.—Profile of Bleiblerville clay, 1 to 3 percent slopes. Large slickensides are between depths of 2 and 4 feet.

CB—54 to 72 inches; white (10YR 8/1) clay, light gray (10YR 7/1) moist; few fine prominent yellowish brown (10YR 5/8) mottles; weak coarse angular blocky structure parting to weak fine and medium angular blocky; extremely hard, very firm; few dark gray (10YR 4/1) streaks; few intersecting slickensides; few coarse concretions of calcium

carbonate; few pockets of reddish brown (2.5YR 5/4) clay; segregations of carbonate surrounding carbonate nodules; mildly alkaline; gradual wavy boundary.

C—72 to 80 inches; white (10YR 8/1) clay, light gray (10YR 7/1) moist; massive; extremely hard, firm; few slickensides; few selenite crystals; few segregations of gypsum; few streaks and masses of reddish brown (2.5YR 5/4) clay; mildly alkaline.

The thickness of the solum ranges from 60 to more than 70 inches. In undisturbed areas gilgai microknolls are 6 to 16 inches higher than microdepressions. The center of the microknolls is 5 to 11 feet from the center of the microdepressions. During dry periods, cracks 1 to 3 inches wide extend from the surface to a depth of more than 20 inches. Intersecting slickensides begin at a depth of about 6 to 14 inches. The content of clay ranges from 55 to 70 percent. Many pedons have a few fine shell fragments throughout.

The A horizon ranges from 6 to 20 inches in thickness in the microdepressions and from 6 to 12 inches in the microknolls. It averages more than 12 inches thick in more than 60 percent of the pedons. It is black or very dark gray clay. The number of fine concretions of calcium carbonate and fine dark concretions ranges from none to common. This horizon is calcareous in most pedons and is mildly alkaline or moderately alkaline.

The Bw, Bk, and BC horizons are gray, dark gray, very dark gray, light brownish gray, olive gray, or light olive gray. They have few to many very fine, fine, or medium concretions of calcium carbonate. The number of fine black concretions is none or few. These horizons are calcareous and are mildly alkaline or moderately alkaline. The combined thickness of these horizons ranges from 40 to more than 60 inches.

The CB and C horizons have a matrix in shades of white, gray, brown, or yellow. Most pedons have mottles in shades of brown, yellow, or gray that contrast with the matrix. These horizons have few to many fine and medium concretions of calcium carbonate and fine black concretions.

Some of the Bleiblerville soils in this county are outside the range of the series because the content of clay is more than 60 percent below the Ap horizon. This difference, however, does not affect use and management of the soils.

Branyon Series

The Branyon series consists of nearly level, very deep, moderately well drained, very slowly permeable soils on terraces along the Lavaca and Navidad Rivers and along some of their large tributaries (fig. 19). These soils formed in calcareous, clayey alluvium. Slopes are dominantly less than 1 percent. The soils are fine, montmorillonitic, thermic Udic Pellusterts.

Typical pedon of Branyon clay, 0 to 1 percent slopes; from Breslau, 1.1 miles north on Farm Road 957, about 1.6 miles west-northwest on a gravel road, 0.9 mile southwest, and 200 feet northwest in a field:

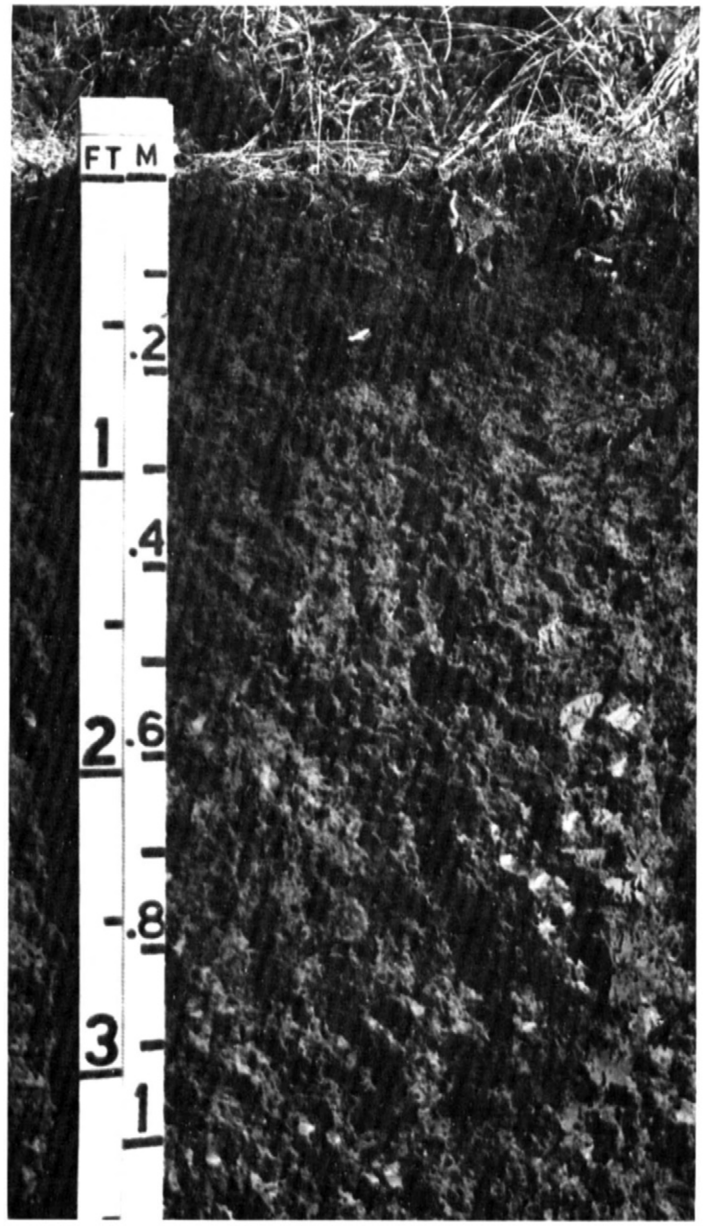

Figure 19.—Profile of Branyon clay, 0 to 1 percent slopes, showing the shiny pressure faces and slickensides.

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak medium granular structure; very hard, firm; many fine and medium roots; calcareous; neutral; clear smooth boundary.

A—6 to 20 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium angular blocky structure parting to weak fine granular; very hard, firm; many fine and medium roots; few fine pressure faces; calcareous; mildly alkaline; gradual wavy boundary.

Bw—20 to 32 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate coarse angular blocky structure parting to moderate fine angular blocky; very hard, very firm; common fine and medium roots; few black (10YR 2/1) streaks along cracks; common large intersecting slickensides; few very fine segregations of calcium carbonate; few horizontally oriented thin pockets of dark grayish brown (10YR 4/2) sand; calcareous; mildly alkaline; clear wavy boundary.

Bk1—32 to 45 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common medium faint brown (10YR 4/3) mottles; moderate coarse angular blocky structure parting to weak medium angular blocky; extremely hard, very firm; common fine roots; few black (10YR 2/1) streaks along cracks; common large intersecting slickensides; common fine and medium segregations of calcium carbonate; few fine concretions of carbonate; calcareous; mildly alkaline; clear wavy boundary.

Bk2—45 to 55 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; many coarse distinct olive brown (2.5Y 4/4) and few fine prominent yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very hard, very firm; few fine roots; few black (10YR 2/1) streaks along cracks; common large intersecting slickensides; common fine and medium concretions of calcium carbonate; few fine and medium segregations of carbonate; calcareous; moderately alkaline; clear wavy boundary.

2Bk3—55 to 65 inches; light gray (10YR 6/1) sandy clay loam, gray (10YR 5/1) moist; many coarse distinct light olive brown (2.5Y 5/4) and few fine prominent yellowish brown (10YR 5/8) mottles; moderate coarse angular blocky structure; hard, firm; few fine roots and pores; continuous dark gray (10YR 4/1) coatings on faces of peds; common or many concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

2Bk4—65 to 80 inches; light gray (10YR 7/1) sandy clay loam, gray (10YR 5/1) moist; common medium distinct light olive brown (2.5Y 5/4) and few fine prominent yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; hard, firm; few fine roots and pores; few white (10YR 8/2) filaments of calcium carbonate; few to many concretions of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The soils are dominantly calcareous. They are neutral to moderately alkaline clay in the upper 50 inches. The content of clay in the upper 40 inches ranges from 45 to 60 percent. During dry periods, cracks 1 to 2 inches wide extend from the surface to a depth of more than 20 inches. Most pedons have a few black concretions throughout.

The A horizon is very dark gray or dark gray. It ranges from 20 to more than 40 inches in thickness in more than 60 percent of the pedons. This horizon has intrusions of the Bw and Bk horizons at intervals of about 5 feet.

The Bw and Bk horizons are gray, dark gray, grayish brown, light gray, light brownish gray, pale brown, or brown. Darker streaks of material from the A horizon and lighter colored splotches or streaks of material from the C horizon are common. The combined thickness of the Bw and Bk horizons ranges from 20 to more than 60 inches.

The 2Bk horizon and the C horizon, if it occurs, are light gray, very pale brown, yellow, or brownish yellow. They are sandy clay, clay, clay loam, or sandy clay loam. They have few to many fine and medium concretions of calcium carbonate and fine black concretions.

Carbengle Series

The Carbengle series consists of gently sloping to strongly sloping, moderately deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous, loamy sediments interbedded with sandstone of the Oakville Sandstone and Fleming Formation. Slope ranges from 1 to 8 percent. The soils are fine-loamy, carbonatic, thermic Typic Calciustolls.

Typical pedon of Carbengle loam, 3 to 5 percent slopes; from Hallettsville, 10 miles west on U.S. Highway 90A, about 1 mile south on Farm Road 531, about 0.52 mile west on a paved county road, and 50 feet north in a pasture:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; few very fine concretions of calcium carbonate; few snail shells; calcareous; moderately alkaline; clear smooth boundary.

A—5 to 13 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark brown (10YR 2/2) moist;

weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine roots; few very fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk—13 to 32 inches; light gray (10YR 7/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; few fine roots; common films and few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Crk—32 to 80 inches; very pale brown, weakly consolidated sandstone interbedded with unconsolidated loamy sediments; common soft accumulations and few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The content of clay in the 10- to 40-inch control section ranges from 25 to about 34 percent. The calcium carbonate equivalent is 40 to 65 percent.

The A horizon is dark grayish brown, dark gray, very dark grayish brown, very dark gray, or gray. Snail shells are common on the surface. This horizon ranges from 7 to 16 inches in thickness.

The Bk horizon is light gray, light brownish gray, pale brown, grayish brown, or brown. It is sandy clay loam or clay loam. It ranges from 13 to more than 30 inches in thickness.

The Crk horizon is white, light gray, very pale brown, or yellow. Calcium carbonate ranges from soft accumulations to cemented concretions. This horizon is strongly cemented to weakly cemented sandstone interbedded with loamy sediments. Some pedons have interspersed strata of coarse sand.

Catilla Series

The Catilla series consists of gently sloping, very deep, moderately well drained, moderately slowly permeable, sandy soils on uplands. These soils formed in thick sandy and loamy sediments of the Willis Formation. Slope ranges from 1 to 5 percent. The soils are loamy, siliceous, thermic Grossarenic Paleustalfs.

Typical pedon of Catilla loamy sand, 1 to 5 percent slopes; from Yoakum, 7 miles southeast on Texas Highway 111, about 1 mile south on Farm Road 1447 to the Brushy Creek bridge, 0.1 mile south, and 300 feet west in an area of heavily wooded rangeland:

A—0 to 10 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grained; loose, very friable; many medium and fine roots; slightly acid; clear smooth boundary.

E—10 to 49 inches; very pale brown (10YR 8/4) loamy sand, light yellowish brown (10YR 6/4) moist; single grained; loose, very friable; common fine roots; slightly acid; abrupt wavy boundary.

Bt1—49 to 60 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many coarse prominent red (2.5YR 4/6) mottles; moderate coarse subangular blocky structure; very hard, firm; few fine roots; clay films on faces of peds; medium acid; diffuse wavy boundary.

Bt2—60 to 72 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; many medium prominent red (2.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; clay films on faces of peds; medium acid; gradual wavy boundary.

Bt3—72 to 80 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; common medium prominent yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; slightly hard, firm; few clay films on faces of peds; slightly acid.

The thickness of the solum ranges from 60 to more than 100 inches. Some pedons have siliceous pebbles that range to as much as 5 percent, by volume. The content of clay in the control section is 25 to 32 percent.

The A horizon is grayish brown, light brownish gray, light gray, pale brown, or yellowish brown. It is medium acid or slightly acid. It is 8 to 16 inches thick.

The E horizon is light brownish gray, light yellowish brown, light gray, pale brown, or very pale brown. It is medium acid or slightly acid. It is 26 to 51 inches thick.

The Bt horizon is pale brown, light yellowish brown, light gray, very pale brown, or light brownish gray. Mottles are in shades of red, yellow, or brown. Reaction ranges from slightly acid to very strongly acid. This horizon is 18 to more than 40 inches thick. It averages sandy clay loam, but the upper 6 to 10 inches may be sandy clay in some pedons. The number of black concretions is few or none.

The C horizon, if it occurs within a depth of 80 inches, is gray with mottles in shades of brown, yellow, or red. It is mainly sandy clay loam.

Cieno Series

The Cieno series consists of nearly level and slightly concave, very deep, poorly drained, very slowly permeable soils on uplands. These soils formed in calcareous, loamy sediments of the Lissie Formation. Slope is 0 to 1 percent. The soils are fine-loamy, siliceous, hyperthermic Typic Ochraqualfs.

Typical pedon of Cieno loam, in an area of the Morales-Cieno complex, 0 to 1 percent slopes; from Hallettsville, 17 miles south on U.S. Highway 77, about 9.5 miles southeast on Texas Highway 111, about 0.85 mile north on Texana Road, and 100 feet east in a pasture in a closed depression:

A—0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, firm; many fine and medium roots; neutral; clear smooth boundary.

Btg1—6 to 35 inches; light gray (10YR 6/1) sandy clay loam, dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; extremely hard, firm; few fine roots; uncoated sand on faces of some peds; few crawfish krotovinas; neutral; clear smooth boundary.

Btg2—35 to 46 inches; light gray (10YR 6/1) sandy clay loam, grayish brown (10YR 5/2) moist; common coarse prominent strong brown (7.5YR 4/6) mottles; moderate coarse blocky structure; extremely hard, firm; grayish brown sand grains coating faces of many peds; neutral; gradual smooth boundary.

Btg3—46 to 64 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; common medium prominent brownish yellow (10YR 6/8) mottles; moderate coarse angular blocky structure; very hard, firm; pale brown sand grains coating faces of some peds; neutral; diffuse smooth boundary.

BC—64 to 80 inches; white (2.5Y 8/2) sandy clay loam, light gray (2.5Y 7/2) moist; common fine and medium prominent brownish yellow (10YR 6/8) mottles; moderate coarse angular blocky structure; very hard, firm; few concretions of carbonate; common fine black concretions in the upper part, few in the lower part; pale brown sand grains coating faces of a few peds; neutral.

The thickness of the solum ranges from 60 to more than 80 inches. Free carbonates are at a depth of more than 50 inches in most pedons. Uncoated sand grains are on the faces of some peds. They extend throughout the argillic horizon but make up less than 5 percent of the matrix. The number of black concretions 4 to 10 millimeters in diameter is none or few throughout.

The A horizon is light brownish gray, brown, light gray, gray, or grayish brown. A few pedons have mottles in shades of brown or yellow. Reaction ranges from medium acid to neutral. This horizon is 6 to 16 inches thick.

The Btg horizon is gray, light gray, light brownish gray, or grayish brown. It has few or common mottles in shades of brown or yellow. It is sandy clay, sandy clay loam, or clay loam. The average content of clay in the control section is 27 to 35 percent. Reaction ranges from medium acid to moderately alkaline. This horizon is 55 to 70 inches thick.

The BC horizon is light gray, gray, or white. It has few or common mottles in shades of brown or yellow. It is sandy clay loam or clay loam. The number of films, threads, and concretions of calcium carbonate is few or none. Reaction ranges from neutral to moderately alkaline.

Cuero Series

The Cuero series consists of gently sloping, deep, well drained, moderately permeable soils on upland foot slopes. These soils formed in calcareous, loamy sediments over interbedded sandstone of the Oakville Sandstone and Fleming Formation. Slope ranges from 1 to 3 percent. The soils are fine-loamy, mixed, thermic Pachic Argiustolls.

Typical pedon of Cuero sandy clay loam, 1 to 3 percent slopes; from Shiner, 1.3 miles west on U.S. Highway 90A, about 0.2 mile southwest on Farm Road 533, and 200 feet southeast in a native pasture:

A—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; many fine and common medium roots; neutral; clear smooth boundary.

Bt1—8 to 22 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable; common fine roots; neutral; gradual smooth boundary.

Bt2—22 to 36 inches; reddish brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; common fine roots, moderately alkaline; clear smooth boundary.

Btk—36 to 48 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; common very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C/Cr—48 to 52 inches; pale brown (10YR 6/3) sandy clay loam (C part) that has interbedded, weakly cemented sandstone (Cr part); brown (10YR 5/3) moist; few fine soft masses of calcium carbonate;

calcareous; moderately alkaline; abrupt smooth boundary.
Cr—52 inches; weakly cemented sandstone.

The thickness of the solum ranges from 30 to 60 inches. The mollic colors extend to a depth of 20 to 26 inches. The average content of clay in the control section ranges from 25 to 35 percent. The depth to segregated calcium carbonate is 20 to 36 inches.

The A horizon is very dark gray or very dark grayish brown. It ranges from slightly acid to mildly alkaline. It is 7 to 12 inches thick.

The Bt horizon is very dark gray, very dark grayish brown, dark grayish brown, or dark brown in the upper part and dark brown, brown, dark yellowish brown, dark reddish brown, or reddish brown in the lower part. It is sandy clay loam or clay loam. It ranges from neutral to moderately alkaline. It is 18 to 48 inches thick.

The C or Cr horizon is pink, brownish yellow, brown, pale brown, or yellowish red. It is sandy clay loam or clay loam and in some pedons is interbedded with weakly cemented, calcareous sandstone. Many pedons have few to many concretions and threads of calcium carbonate.

Dacosta Series

The Dacosta series consists of nearly level, very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in calcareous, loamy and clayey sediments of the Lissie Formation. Slope is 0 to 1 percent. The soils are fine, montmorillonitic, hyperthermic Vertic Ochraqualfs.

Typical pedon of Dacosta sandy clay loam, 0 to 1 percent slopes; from Hallettsville, 11 miles south on U.S. Highway 77, about 4.4 miles east on Farm Road 531 to Ezzell, 4.5 miles southeast on a paved county road to Wallace Bridge at the Lavaca River, 2.2 miles south on Texana Road, 500 feet east on a private road, and 50 feet south in an area of rangeland:

A—0 to 6 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; massive; very hard, firm; common fine roots; few black concretions 1 to 2 millimeters in diameter; neutral; gradual smooth boundary.
BA—6 to 18 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few black concretions 1 to 2 millimeters in diameter; neutral; gradual wavy boundary.
Btg1—18 to 26 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few black concretions 1 to 2 millimeters in diameter; neutral; gradual wavy boundary.
Btg2—26 to 36 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; weak medium angular blocky structure; very hard, very firm; few fine roots; few black concretions 1 to 2 millimeters in diameter; neutral; gradual wavy boundary.
Btg3—36 to 48 inches; light gray (10YR 6/1) clay loam, gray (10YR 5/1) moist; many coarse prominent yellowish red (5YR 4/6) mottles; weak coarse angular blocky structure; very hard, very firm; few fine roots; common black concretions 1 to 2 millimeters in diameter; mildly alkaline; gradual smooth boundary.
Bg—48 to 62 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; weak medium prismatic structure parting to weak medium angular blocky; very hard, very firm; few fine roots; moderately alkaline; gradual smooth boundary.
C—62 to 80 inches; white (2.5Y 8/2) sandy clay loam, light gray (2.5Y 7/2) moist; massive; very hard, firm; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. During dry periods, cracks 0.4 inch to 2 inches wide extend to a depth of 20 inches or more. The number of black concretions ranges from none to common.

The A horizon is grayish brown, gray, dark gray, or very dark gray. It is slightly acid or neutral. It ranges from 5 to 15 inches in thickness.

The BA horizon, if it occurs, is dark gray or very dark gray. It is sandy clay or clay loam. It ranges from slightly acid to mildly alkaline. It is 4 to 14 inches thick.

The Btg horizon is dark gray, gray, light gray, or very dark gray. Some pedons have mottles of contrasting colors. This horizon is sandy clay, clay loam, or clay. It ranges from slightly acid to mildly alkaline. It is 33 to 50 inches thick.

The Bg horizon is light gray, gray, dark gray, or light brownish gray. Some pedons are mottled with contrasting colors. This horizon is clay loam, clay, or sandy clay. It is mildly alkaline or moderately alkaline. It ranges from 6 to 25 inches in thickness.

The C horizon is white, light gray, gray, or brown. It is not mottled or has few to many mottles in contrasting colors. It is sandy clay, sandy clay loam, or clay loam. It ranges from neutral to moderately alkaline.

Denhawken Series

The Denhawken series consists of gently sloping, very deep, well drained, very slowly permeable soils on ridges in the uplands. These soils are mapped only in a

complex with Elmendorf soils. They formed in calcareous, shaly clays of the Goliad Formation and Fleming Formation. Slope ranges from 1 to 3 percent. The soils are fine, montmorillonitic, hyperthermic Vertic Ustochrepts.

Typical pedon of Denhawken clay loam, in an area of the Denhawken-Elmendorf complex, 1 to 3 percent slopes; from Farm Road 531 in Sweet Home, 2.2 miles southwest on Farm Road 318, about 3.2 miles southeast on Farm Road 2543 to Pilot Grove, 1.4 miles south, 0.25 mile west, and 100 feet north on a microknoll in a pasture:

A—0 to 6 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; very hard, firm; common fine and medium roots; few siliceous pebbles; calcareous; moderately alkaline; clear wavy boundary.

Bw—6 to 22 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; few fine faint light yellowish brown (10YR 6/4) mottles; weak fine and medium angular blocky structure; very hard, very firm; few fine roots; few fine concretions and soft masses of calcium carbonate; few siliceous pebbles; calcareous; moderately alkaline; clear wavy boundary.

Bk—22 to 43 inches; very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) moist; common fine distinct brownish yellow (10YR 6/8) mottles; weak coarse angular blocky structure; very hard, very firm; few fine roots; few intersecting slickensides; about 5 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1—43 to 64 inches; very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) moist; common medium distinct brownish yellow (10YR 6/8) mottles; very hard, very firm; common intersecting slickensides; shiny pressure faces on aggregates; about 3 percent, by volume, concretions and soft masses of calcium carbonate; few black concretions 1 to 2 millimeters in diameter; calcareous; moderately alkaline; clear wavy boundary.

C2—64 to 70 inches; very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; very hard, very firm; common intersecting slickensides; shiny pressure faces on aggregates; about 3 percent, by volume, concretions and soft masses of calcium carbonate; few black concretions 1 to 2 millimeters in diameter; calcareous; moderately alkaline; clear wavy boundary.

C3—70 to 80 inches; pink (7.5YR 7/4) clay, light brown (7.5YR 6/4) moist; massive; very hard, very firm; about 3 percent, by volume, concretions of calcium carbonate; few black concretions 1 to 2 millimeters in diameter; calcareous; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The soils are calcareous. They are moderately alkaline throughout. During dry periods, cracks 1 or 2 inches wide extend from the surface to a depth of more than 20 inches. Pressure faces are evident within a depth of 10 to 20 inches.

The A horizon is dark grayish brown, grayish brown, light brownish gray, or dark gray. It is clay loam or sandy clay loam. Some pedons have few fine concretions of calcium carbonate. This horizon ranges from 6 to 10 inches in thickness.

The Bw and Bk horizons are light brownish gray, grayish brown, light gray, or very pale brown. The Bk horizon also is brownish yellow. These horizons are clay or clay loam. Some pedons have a few siliceous pebbles throughout. The combined thickness of the Bw and Bk horizons ranges from 35 to 48 inches. The content of clay in the control section is 37 to 50 percent.

The C horizon is very pale brown, light yellowish brown, brownish yellow, brown, light brown, pink, or reddish yellow. This horizon has common intersecting slickensides, some black concretions, and as much as 20 percent, by volume, segregations of calcium carbonate. The content of crystalline gypsum ranges from 0 to 10 percent, by volume.

Dietrich Series

The Dietrich series consists of nearly level, very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in calcareous, loamy and clayey sediments on ancient terraces. Slope is 0 to 1 percent. The soils are fine-loamy, mixed, hyperthermic Typic Natraqualfs.

Typical pedon of Dietrich fine sandy loam, 0 to 1 percent slopes; from Yoakum, 6.2 miles southeast on Texas Highway 111, about 0.7 mile north and 0.81 mile west (past Supplejack Creek bridge) on an unpaved road, and 400 feet south in a pasture:

A1—0 to 3 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; very hard, firm; many fine and medium roots; few fine threads of powdery salt crystals; slightly acid; clear smooth boundary.

A2—3 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist;

moderate coarse subangular blocky structure; hard, firm; common fine and medium roots; few threads and pockets of powdery salt crystals; neutral; clear wavy boundary.

Btnzg1—12 to 32 inches; gray (10YR 5/1) sandy clay loam, dark gray (10YR 4/1) moist; moderate coarse prismatic structure parting to strong coarse subangular blocky; very hard, firm; few fine threads and pockets of powdery salt crystals; saline; mildly alkaline; gradual wavy boundary.

Btnzg2—32 to 52 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, firm; common fine and few medium concretions of calcium carbonate; few fine black concretions; few fine siliceous pebbles; saline; calcareous; moderately alkaline; gradual wavy boundary.

Btnzg3—52 to 72 inches; white (10YR 8/1) sandy clay loam, light gray (10YR 7/1) moist; few fine faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; few fine concretions of calcium carbonate; few black concretions; few fine siliceous pebbles; saline; moderately alkaline; gradual wavy boundary.

C—72 to 80 inches; white (10YR 8/1) fine sandy loam, light gray (10YR 7/2) moist; few fine distinct strong brown (7.5YR 5/6) mottles; massive; hard, firm; common fine and medium black concretions; few very fine white concretions; saline; moderately alkaline.

The thickness of the solum ranges from 50 to more than 80 inches. Most pedons contain threads and pockets of powdery salt crystals. Conductivity of the saturation extract ranges from about 1 to 8 millimhos per centimeter. It increases with depth.

The A horizon is grayish brown, light brownish gray, or light gray. It is slightly acid or neutral. Salt crystals make up 1 to 5 percent, by volume. This horizon ranges from 9 to 15 inches in thickness.

Some pedons have a Btng horizon. This horizon is dark grayish brown, gray, or grayish brown. It is sandy clay loam or clay loam. It ranges from 0 to 32 inches in thickness. Reaction is mildly alkaline or moderately alkaline.

The Btnzg horizon is gray, grayish brown, white, or light gray. It is clay loam or sandy clay loam. It ranges from 17 to more than 60 inches in thickness. Reaction is mildly alkaline or moderately alkaline.

The C horizon is white, light gray, light brownish gray, pale brown, or very pale brown. It is fine sandy loam, sandy clay loam, or sandy clay.

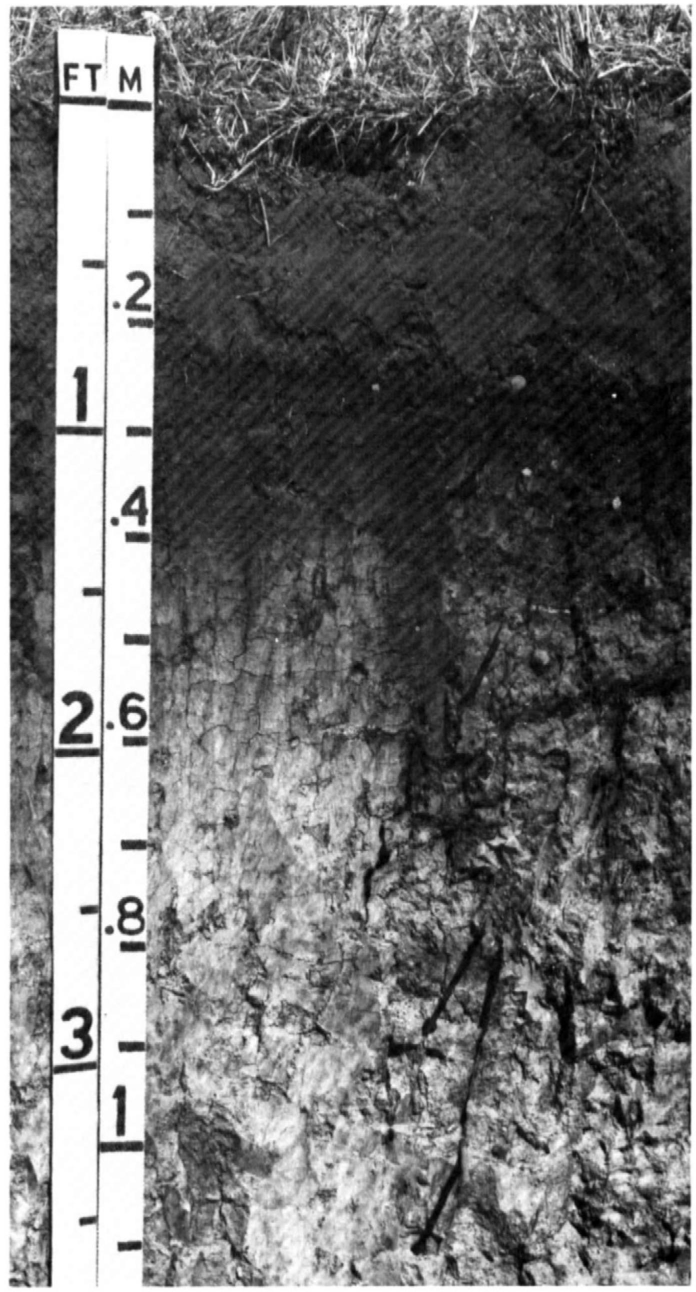

Figure 20.—Profile of Dubina loamy fine sand, 1 to 3 percent slopes, showing the dark colored mollic epipedon to a depth of 17 inches and the lighter colored argillic horizon.

Dubina Series

The Dubina series consists of gently sloping, very deep, moderately well drained, slowly permeable soils on uplands (fig. 20). These soils formed in alkaline, loamy and sandy sediments of the Goliad and Fleming Formations. Slope ranges from 1 to 3 percent. The soils

are fine, montmorillonitic, thermic Aquic Paleustolls.

Typical pedon of Dubina loamy fine sand, 1 to 3 percent slopes; from Hallettsville, 7.4 miles north on U.S. Highway 77, about 1.2 miles east on New Kinkler Road, 1.6 miles north-northeast on a gravel road, and 450 feet north of a gate in a bermudagrass pasture:

A—0 to 11 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose, very friable; common fine and medium roots; medium acid; abrupt smooth boundary.

Bt1—11 to 17 inches; dark grayish brown (10YR 4/2) sandy clay, very dark grayish brown (10YR 3/2) moist; common medium distinct dark red (2.5YR 3/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine and few medium roots; slightly acid; gradual smooth boundary.

Bt2—17 to 24 inches; brown (10YR 5/3) sandy clay, dark brown (10YR 4/3) moist; common medium distinct red (2.5YR 4/6) and few fine faint reddish yellow (5YR 6/8) mottles; moderate medium subangular blocky structure; extremely hard, very firm; many fine roots; medium acid; gradual smooth boundary.

Bt3—24 to 33 inches; brown (10YR 5/3) sandy clay, dark brown (10YR 4/3) moist; common fine distinct red (2.5YR 4/8) and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; very hard, firm; few fine roots; medium acid; gradual smooth boundary.

Bt4—33 to 43 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/8) and red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; very hard, firm; few fine roots; medium acid; clear smooth boundary.

BC1—43 to 61 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; moderate fine subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

BC2—61 to 69 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; neutral; abrupt smooth boundary.

C—69 to 80 inches; white (10YR 8/2) loamy sand, very pale brown (10YR 7/3) moist; single grained; loose, very friable; calcareous; moderately alkaline.

The thickness of the solum ranges from 50 to more than 80 inches. The mollic epipedon is 12 to 19 inches thick. Some pedons have secondary carbonates below a depth of 36 inches.

The A horizon is brown, dark grayish brown, grayish brown, or dark brown. It ranges from medium acid to neutral. It is 8 to 19 inches thick.

The upper part of the Bt horizon is dark brown, brown, dark grayish brown, or grayish brown. The lower part of the Bt horizon is brown, grayish brown, yellowish brown, light yellowish brown, light brownish gray, or pale brown. The Bt horizon has common or many mottles in shades of brown, gray, yellow, or red. It is sandy clay or clay in the upper part and sandy clay loam or clay loam in the lower part. It is 32 to more than 50 inches thick. Reaction ranges from medium acid to moderately alkaline. The number of noncalcareous, soft, white masses and concretions of calcium carbonate ranges from none to many.

The BC and C horizons are reddish yellow, strong brown, brown, light brown, yellowish red, brownish yellow, light gray, white, or pink. They are not mottled or have few or common mottles in shades of gray, red, yellow, or brown. They are sandy loam, loamy sand, or sandy clay loam. Some pedons have interbedded strata of packsand or other kinds of sandstone. These horizons range from slightly acid to moderately alkaline. The number of noncalcareous, soft, white masses, black concretions, and concretions of calcium carbonate ranges from none to many.

Dutek Series

The Dutek series consists of gently sloping, very deep, well drained, moderately permeable soils on uplands. These soils formed in sandy and loamy sediments on ancient terraces. Slope ranges from 1 to 5 percent. The soils are loamy, siliceous, thermic Arenic Haplustalfs.

Typical pedon of Dutek loamy fine sand, 1 to 5 percent slopes; from U.S. Highway 77 in Hallettsville, 0.8 mile east on U.S. Highway 90A, about 11 miles southeast on Farm Road 530, and 85 feet northeast in an area of rangeland; 0.6 mile south-southeast of Vienna:

A—0 to 10 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; common fine roots; slightly acid; clear smooth boundary.

E—10 to 28 inches; very pale brown (10YR 8/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; weak fine granular structure; soft, very friable; few fine roots; slightly acid; abrupt wavy boundary.

Bt1—28 to 38 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; common coarse prominent dark yellowish brown (10YR 4/6) and common

medium distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; nearly continuous clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—38 to 52 inches; light red (2.5YR 6/8) sandy clay loam, red (2.5YR 5/8) moist; weak medium subangular blocky structure; very hard, very firm; few clay films on faces of peds; very strongly acid; gradual wavy boundary.

BC—52 to 65 inches; reddish yellow (5YR 7/8) sandy loam, reddish yellow (5YR 6/8) moist; common coarse distinct red (2.5YR 5/8) mottles; weak fine granular structure; hard, friable; very strongly acid; gradual smooth boundary.

2C—65 to 80 inches; yellow (10YR 8/6) loamy sand, yellow (10YR 7/6) moist; single grained; soft, very friable; slightly acid.

The thickness of the solum ranges from 60 to more than 75 inches. The average content of clay in the control section is 20 to 30 percent.

The A horizon is pale brown, strong brown, brown, light brown, yellowish brown, or light yellowish brown. It ranges from medium acid to neutral. It is 5 to 15 inches thick.

The E horizon is very pale brown, brown, pale brown, light yellowish brown, or yellowish brown. It is loamy fine sand or loamy sand. It ranges from medium acid to neutral. It is 13 to 27 inches thick.

The Bt1 horizon is yellowish red, reddish yellow, red, or light red. It is not mottled or has few or common mottles in shades of red, yellow, or brown. It is sandy clay or sandy clay loam. The Bt2 horizon is red, reddish yellow, or light red. It is not mottled or has few mottles in shades of red, yellow, or brown. This horizon is sandy clay loam, fine sandy loam, or sandy loam. The Bt1 and Bt2 horizons range from very strongly acid to medium acid. The combined thickness of these horizons ranges from 14 to 30 inches.

The BC horizon is reddish yellow, yellowish red, brown, or strong brown. It is fine sandy loam or sandy loam. It ranges from 6 to 16 inches in thickness. Reaction ranges from very strongly acid to slightly acid.

The C horizon is yellow or reddish yellow. It is loamy sand, loamy fine sand, or very fine sand.

Edna Series

The Edna series consists of nearly level, very deep, poorly drained, very slowly permeable soils on uplands. These soils formed in clayey and loamy sediments of the Lissie Formation. Slope is 0 to 1 percent. The soils are fine, montmorillonitic, thermic Vertic Albaqualfs.

Typical pedon of Edna fine sandy loam, 0 to 1 percent slopes; 23 miles southeast of Hallettsville on Farm Road 530 to Speaks store, 200 feet south of store, 0.4 mile east on a pasture road, and 100 feet south in a pasture:

A—0 to 6 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; very hard, friable; common fine roots; medium acid; clear smooth boundary.

E—6 to 8 inches; white (10YR 8/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; common fine roots; medium acid; abrupt wavy boundary.

Btg1—8 to 18 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few medium distinct light yellowish brown (10YR 6/4) mottles; strong medium angular blocky structure; extremely hard, very firm; few fine roots; medium acid; gradual wavy boundary.

Btg2—18 to 29 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; mildly alkaline; gradual wavy boundary.

Btg3—29 to 40 inches; light gray (10YR 6/1) sandy clay, dark gray (10YR 4/1) moist; few distinct light yellowish brown (10YR 6/4) mottles; moderate medium angular blocky structure; extremely hard, firm; few fine roots; moderately alkaline; gradual wavy boundary.

Btg4—40 to 48 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; few medium prominent brownish yellow (10YR 6/6) mottles; moderate medium angular blocky structure; extremely hard, firm; few fine roots; moderately alkaline; clear smooth boundary.

BC—48 to 62 inches; light gray (2.5Y 7/2) sandy clay, light brownish gray (2.5Y 6/2) moist; common medium prominent brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; very hard, firm; few fine noncalcareous white concretions; moderately alkaline; gradual wavy boundary.

C—62 to 80 inches; white (5Y 8/2) sandy clay loam, light olive gray (5Y 6/2) moist; common medium prominent brownish yellow (10YR 6/6) mottles; massive; hard, friable; few clean sand grains on faces of peds; moderately alkaline.

The thickness of the solum ranges from 60 to more than 70 inches. The number of dark concretions, noncalcareous white concretions, and concretions of

carbonate ranges from none to many in the Btg, BC, and C horizons.

The A horizon is dark gray, gray, light gray, dark grayish brown, or grayish brown. The E horizon, if it occurs, is lighter colored than the A horizon. Some pedons have mottles of contrasting colors in the lower part of the A and E horizons. The A and E horizons range from medium acid to neutral. The combined thickness of these horizons ranges from 5 to 16 inches.

The Btg horizon is dark gray, gray, light gray, dark grayish brown, light brownish gray, or grayish brown. It has mottles in shades of yellow or brown. It is sandy clay or clay. The content of clay ranges from 35 to 55 percent in the control section. This horizon ranges from medium acid to neutral in the upper part and from slightly acid to moderately alkaline in the lower part. It is 34 to more than 50 inches thick.

The BC and C horizons are light gray, gray, white, or light brownish gray. Mottles are in shades of yellow or brown.

Elmendorf Series

The Elmendorf series consists of gently sloping, very deep, well drained, very slowly permeable soils on broad upland ridges. These soils are mapped only in a complex with Denhawken soils. They formed in calcareous, shaly clays of the Goliad and Fleming Formations. Slope ranges from 1 to 3 percent. The soils are fine, montmorillonitic, hyperthermic, Vertic Argiustolls.

Typical pedon of Elmendorf sandy clay loam, in an area of Denhawken-Elmendorf complex, 1 to 3 percent slopes; from Farm Road 531 in Sweet Home, 2.2 miles southwest on Farm Road 318, about 3.2 miles southeast on Farm Road 2543 to Pilot Grove, 1.4 miles south, 0.25 mile west, and 100 feet north in a microdepression, approximately 15 feet from the Denhawken pedon:

A—0 to 12 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; weak fine subangular blocky structure; hard, firm; common fine and medium roots; neutral; clear wavy boundary.

BA—12 to 25 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak medium angular blocky structure; hard, firm; few patchy clay films on faces of peds; common fine roots; neutral; clear wavy boundary.

Bt—25 to 42 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak coarse angular blocky structure; very hard, very firm; few fine roots; shiny pressure faces on aggregates; neutral; clear wavy boundary.

Btk—42 to 54 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak coarse angular blocky structure; very hard, very firm; few fine roots; shiny pressure faces on aggregates; few fine concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bk—54 to 80 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common medium distinct reddish yellow (7.5YR 6/6) mottles below a depth of 68 inches; weak coarse angular blocky structure; common pressure faces; 3 to 5 percent concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. During dry periods, cracks 1 to 2 inches wide extend to a depth of more than 50 inches. The thickness of the mollic epipedon ranges from 20 to more than 50 inches. Secondary carbonates are mainly below a depth of 30 inches. They increase with depth.

The A horizon is dark gray, very dark gray, very dark grayish brown, or dark grayish brown. It is clay loam or sandy clay loam. It ranges from slightly acid to moderately alkaline. It is 8 to 14 inches thick.

The BA horizon, if it occurs, is sandy clay or clay loam. It has the same colors as the A horizon. It is neutral to moderately alkaline. It ranges from 0 to 13 inches in thickness.

The Bt horizon is very dark gray, dark gray, grayish brown, dark grayish brown, or gray. It is clay loam, clay, or sandy clay. Some pedons have few mottles of strong brown, yellowish brown, light brown, or reddish yellow. This horizon ranges from neutral to moderately alkaline. The content of clay in the control section ranges from 38 to 50 percent.

The Bk horizon is light gray, gray, dark gray, brown, or grayish brown. It is clay, sandy clay, or sandy clay loam. It has as much as 20 percent, by volume, calcium carbonate.

Falba Series

The Falba series consists of gently sloping, moderately deep and deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in tuffaceous clays and sandstones of the Catahoula and Whitsett Formations. Slope ranges from 1 to 3 percent. The soils are fine, montmorillonitic, thermic Typic Albaqualfs.

Typical pedon of Falba loamy fine sand, 1 to 3 percent slopes; from Farm Road 532 on the west side of Moulton, 2.4 miles northwest on Farm Road 1680 to the Old Moulton Church, 2.1 miles north on an unpaved

road, and 50 feet east in a pasture on a utility line right-of-way:

A—0 to 6 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; single grained; slightly hard, very friable; many medium and fine roots; neutral; gradual wavy boundary.

E—6 to 12 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grained; slightly hard, very friable; common medium and fine roots; medium acid; abrupt wavy boundary.

Btg1—12 to 26 inches; grayish brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; common medium distinct reddish brown (5YR 4/4) mottles; moderate medium angular blocky structure; extremely hard, very firm; few medium and fine roots; few fine white noncalcareous concretions; very strongly acid; gradual wavy boundary.

Btg2—26 to 43 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common medium distinct yellowish red (5YR 4/8) and reddish brown (5YR 4/4) mottles; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few fine white noncalcareous concretions; strongly acid; gradual wavy boundary.

BC—43 to 49 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; few fine and medium distinct reddish yellow (7.5YR 6/8) mottles; weak medium subangular blocky structure; very hard, firm; few black stains; few soft masses of powdery calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Cr1—49 to 66 inches; very pale brown (10YR 7/3), weakly cemented sandstone that crushes to sandy clay loam; pale brown (10YR 6/3) moist; few very fine soft lumps of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cr2—66 to 80 inches; very pale brown (10YR 7/4), weakly cemented sandstone that crushes to fine sandy loam; light yellowish brown (10YR 6/4) moist; few very fine concretions and few soft masses of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. The content of clay in the control section ranges from 40 to 50 percent.

The A horizon is brown, gray, grayish brown, dark gray, or dark grayish brown. It ranges from medium acid to neutral. It is 4 to 7 inches thick.

The E horizon is light gray, very pale brown, gray, or light brownish gray. It is 2 to 16 inches thick. Reaction is similar to that of the A horizon.

The Btg horizon is light gray, gray, light brownish gray, or grayish brown with mottles in shades of red, yellow, or brown. It is sandy clay or clay. It ranges from very strongly acid to slightly acid. It is 24 to 48 inches thick.

The BC horizon is white, light gray, or very pale brown. It is sandy clay loam or fine sandy loam. It has few or common concretions of calcium carbonate.

The Cr horizon is weakly cemented sandstone that crushes easily to sandy clay loam or fine sandy loam. Masses of carbonate are in the sandstone and along rock seams. Some pedons have strata of clay, sandy clay, and siltstone.

The Falba soils in this county are slightly deeper than is defined as the range for the series. They are 30 to 50 inches deep, whereas, the series range is 20 to 40 inches. Also, in some pedons reaction in the solum is higher than is defined as the range for the series. These differences, however, do not significantly affect use and management of the soils.

Flatonia Series

The Flatonia series consists of gently sloping, deep, moderately well drained, slowly permeable soils on uplands. These soils formed in alkaline, tuffaceous clays and sandstones of the Catahoula Formation. Slope ranges from 1 to 3 percent. The soils are fine, montmorillonitic, thermic Vertic Argiustolls.

Typical pedon of Flatonia clay loam, 1 to 3 percent slopes; from Moulton, 2.4 miles north-northwest on Farm Road 1680 to the Old Moulton Church, 0.55 mile west on a gravel road, 0.35 mile south on a gravel road, and 250 feet east in a pasture:

A—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; very hard, firm; many fine and common medium roots; mildly alkaline; clear smooth boundary.

Bt1—6 to 27 inches; very dark gray (10YR 3/1) sandy clay, black (10YR 2/1) moist; moderate medium subangular blocky structure; extremely hard, very firm; shiny pressure faces on aggregates; common fine roots; mildly alkaline; diffuse wavy boundary.

Bt2—27 to 35 inches; dark gray (10YR 4/1) sandy clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; few slickensides and pressure faces; few very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Btk—35 to 42 inches; gray (10YR 5/1) sandy clay, dark

gray (10YR 4/1) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; shiny pressure faces on aggregates; common very fine concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Bk—42 to 48 inches; light gray (10YR 6/1) clay loam, gray (10YR 5/1) moist; moderate medium subangular blocky structure; hard, firm; common fine and few medium concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Cr—48 to 80 inches; stratified, white (10YR 8/1) loamy sediments and very pale brown (10YR 7/3), weakly cemented sandstone; common medium and coarse concretions of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. During dry periods, cracks extend from the surface to the Cr horizon. They are 1 to 2 inches wide at the surface and more than 0.25 inch wide at a depth of 20 inches. Carbonates are below a depth of 24 inches in most pedons, but some small microknolls are calcareous to the surface. The content of clay in the control section ranges from 40 to 50 percent.

The A horizon is very dark grayish brown, very dark gray, very dark brown, or black. It ranges from neutral to moderately alkaline. It is 5 to 15 inches thick.

The Bt, Btk, and Bk horizons are very dark gray, dark gray, gray, light gray, very dark grayish brown, dark brown, grayish brown, or light brownish gray. They are sandy clay, clay, or clay loam. A few slickensides and pressure faces are evident. These horizons have few to many concretions and soft masses of calcium carbonate. They range from neutral to moderately alkaline. They are 25 to 50 inches thick.

The Cr horizon is white, light gray, very pale brown, or brown. It is sandstone that is stratified with loamy or clayey sediments. The content of concretions and soft masses of calcium carbonate ranges from 5 to 20 percent, by volume.

Fordtran Series

The Fordtran series consists of nearly level to gently sloping, very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in sandy, loamy, and clayey sediments of the Lissie Formation. Slope ranges from 0 to 3 percent. The soils are clayey, mixed, hyperthermic Arenic Albaqualfs.

Typical pedon of Fordtran loamy fine sand, 0 to 3 percent slopes; from U.S. Highway 90A in Hallettsville, 21 miles southeast on Farm Road 530, about 3.2 miles north on Farm Road 2437, about 0.25 mile west on a private road, and 75 feet north in an area of rangeland:

A—0 to 7 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, loose; many fine roots; slightly acid; gradual smooth boundary.

E—7 to 24 inches; very pale brown (10YR 8/3) loamy fine sand, very pale brown (10YR 7/3) moist; single grained; soft, loose; common fine roots; slightly acid; abrupt wavy boundary.

Btg1—24 to 33 inches; light gray (10YR 7/2) sandy clay, light brownish gray (10YR 6/2) moist; common medium prominent brownish yellow (10YR 6/6) and many coarse prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm; few fine roots; nearly continuous clay films on faces of peds; medium acid; gradual wavy boundary.

Btg2—33 to 46 inches; white (10YR 8/2) sandy clay, light gray (10YR 7/2) moist; many coarse prominent red (2.5YR 4/6) and common coarse prominent reddish yellow (5YR 6/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm; nearly continuous clay films on faces of peds; few medium black concretions; slightly acid; gradual wavy boundary.

Btg3—46 to 62 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; many coarse prominent red (2.5YR 4/6) mottles; weak coarse blocky structure; extremely hard, firm; patchy clay films on faces of peds; few medium black concretions; neutral; gradual wavy boundary.

Btg4—62 to 72 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many coarse prominent reddish yellow (5YR 6/6) and red (2.5YR 5/8) mottles; weak coarse subangular blocky structure; extremely hard, firm; few fine and medium black concretions; neutral; gradual wavy boundary.

BC—72 to 80 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many coarse prominent reddish yellow (5YR 6/6) mottles; weak coarse subangular blocky structure; extremely hard, firm; common fine and medium black concretions; neutral.

The thickness of the solum ranges from 50 to more than 80 inches. The content of subrounded siliceous pebbles ranges from 0 to 5 percent, by volume.

The A and E horizons are light brownish gray, grayish brown, brown, very pale brown, light gray, or pale brown. They are slightly acid or medium acid. The combined thickness of these horizons ranges from 20 to 40 inches.

The Btg horizon is light gray, white, gray, dark gray, grayish brown, or light brownish gray. It has few to many mottles in shades of yellow, red, brown, or gray. It

is clay or sandy clay in the upper 20 inches and sandy clay loam in the lower part. It ranges from medium acid to mildly alkaline. It is 22 to 50 inches thick.

The BC and C horizons are white, light gray, very pale brown, gray, light brownish gray, or strong brown. They have few to many mottles in shades of yellow, red, or brown. They are sandy clay loam, sandy clay, clay loam, or clay. They range from slightly acid to moderately alkaline.

Frelsburg Series

The Frelsburg series consists of gently sloping to strongly sloping, very deep, well drained, very slowly permeable soils on uplands. These soils formed in calcareous, clayey sediments of the Fleming Formation and Oakville Sandstone. Slope ranges from 1 to 8 percent. The soils are fine, montmorillonitic, thermic Udorthentic Pellusterts.

Typical pedon of Frelsburg clay, 1 to 3 percent slopes; 9 miles north of Hallettsville on U.S. Highway 77, about 8 miles west on Farm Road 532, about 500 feet east of the Komensky store in an area of rangeland, halfway between a microdepression and a microknoll:

A—0 to 8 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate very fine subangular blocky and granular structure; extremely hard, very firm; many fine roots; calcareous; mildly alkaline; clear wavy boundary.

Bw1—8 to 20 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine and very fine subangular blocky structure; extremely hard, very firm; common fine roots; few very dark gray (10YR 3/1) streaks along cracks; few fine black concretions; few fine concretions of calcium carbonate; calcareous; mildly alkaline; gradual wavy boundary.

Bw2—20 to 36 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate coarse and medium angular blocky structure; extremely hard, very firm; common fine roots; few very dark gray (10YR 3/1) streaks along cracks; many slickensides 2 to 4 centimeters apart at a horizontal angle of about 30 degrees toward microlows; few fine black concretions; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bk1—36 to 52 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine distinct light olive brown (2.5Y 5/4) and common medium faint grayish brown (2.5Y 5/2) mottles; moderate coarse and medium angular blocky structure; extremely hard, very firm; few fine roots; few very dark gray (10YR 3/1) streaks along cracks; many intersecting slickensides; few fine black concretions; common concretions and segregations of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bk2—52 to 61 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm; few fine roots; few very dark gray (10YR 3/1) streaks along cracks; common intersecting slickensides at a horizontal angle of about 45 degrees; few fine black concretions; common concretions and segregations of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bk3—61 to 71 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm; few fine roots; few very dark gray (10YR 3/1) streaks along cracks; common intersecting slickensides at a horizontal angle of about 45 degrees; few fine black concretions; common medium segregations and few medium concretions of calcium carbonate; calcareous; mildly alkaline; clear wavy boundary.

BCk—71 to 80 inches; white (2.5Y 8/2) clay, light gray (2.5Y 7/2) moist; few fine distinct brownish yellow (10YR 6/6) mottles; weak coarse angular blocky structure; extremely hard, firm; few fine roots; few very dark gray (10YR 3/1) streaks along cracks; common grayish brown (2.5Y 5/2) intersecting slickensides with few thin darker horizontally oriented bedding planes; few black concretions; few segregations of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The soils are calcareous. They are mildly alkaline or moderately alkaline clay throughout. The content of clay ranges from 45 to 60 percent. During dry periods, cracks 1 to 2 inches wide extend from the surface to a depth of more than 20 inches. Intersecting slickensides and pressure faces begin at a depth of 10 to 20 inches. Cycles of microdepressions and microknolls are repeated at 5- to 15-foot intervals.

The A horizon is dark gray or black. It is 10 to 24 inches thick in the microdepressions and less than 7 inches thick on the microknolls. It averages less than 12 inches thick in more than 60 percent of the pedons.

The Bw horizon is dark gray or gray. It has few or

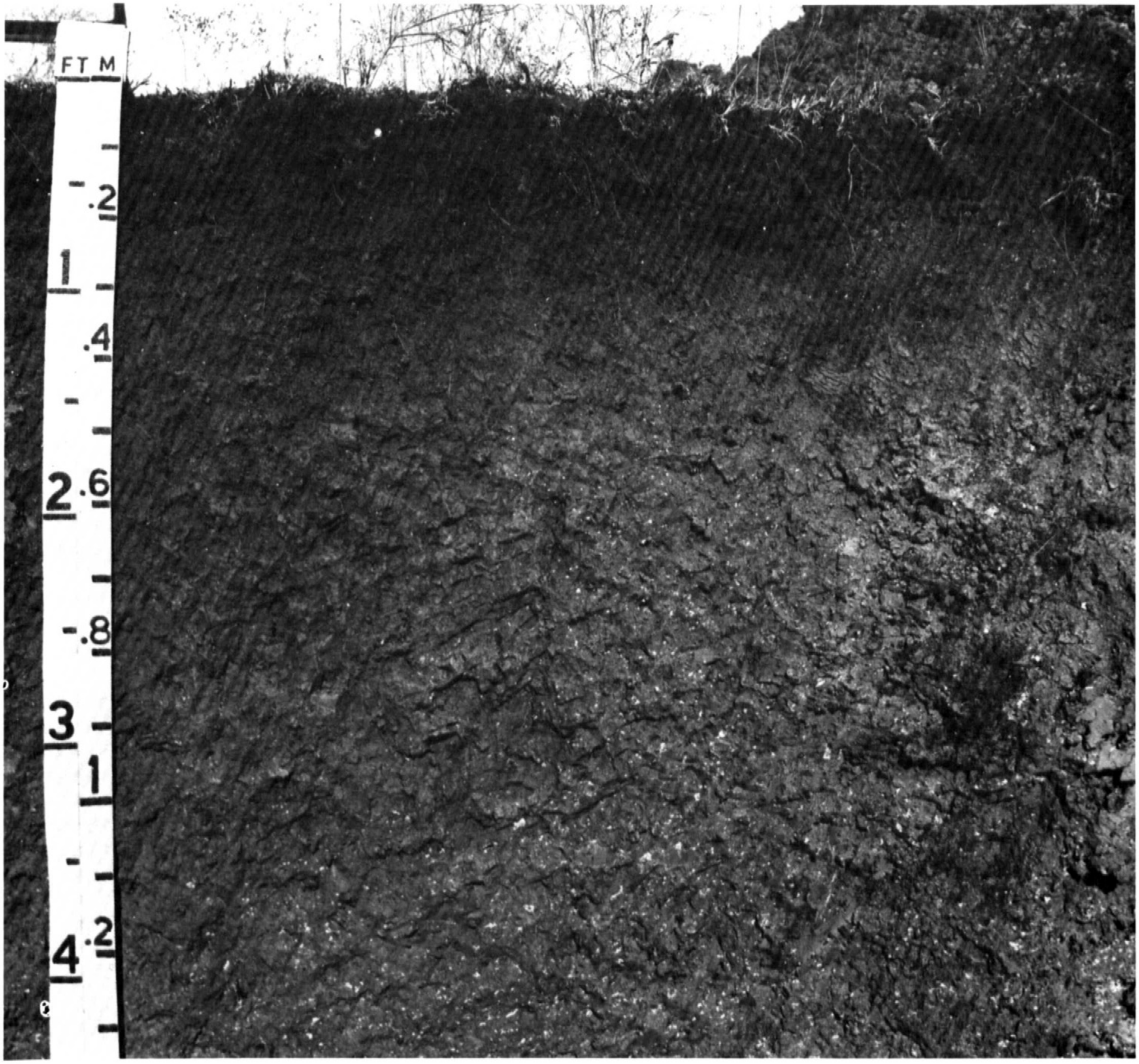

Figure 21.—Profile of Freisburg clay, 1 to 3 percent slopes, showing the calcium carbonate concretions below a depth of 36 inches near the scale and at a depth of 20 inches about 2 feet to the right of the scale. This photograph shows the wavy horizon boundaries in the soil.

common concretions and soft masses of calcium carbonate. The number of black concretions and mottles is none or few.

The Bk horizon is gray, light gray, grayish brown, or light brownish gray. It has few to many concretions and soft masses of calcium carbonate (fig. 21). The number of black concretions and mottles is few or none.

The BCk and C horizons are white, grayish brown, light gray, or yellowish brown. They have few to many soft masses and concretions of calcium carbonate. The

number of black concretions, noncalcareous, white concretions, and salt crystals is few or none.

Greenvine Series

The Greenvine series consists of gently sloping to strongly sloping, moderately deep and deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in interbedded, tuffaceous clayey and loamy sediments of the Catahoula Formation. Slope ranges from 1 to 8 percent. The soils are fine, montmorillonitic, thermic Udic Pellusterts.

Typical pedon of Greenvine clay loam, 1 to 3 percent slopes; from Moulton, 2.4 miles northwest on Farm Road 1680 to the Old Moulton Church, 1 mile north on a gravel road, 0.38 mile east on a private road, and 100 feet south in a pasture:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate fine and very fine subangular blocky structure; extremely hard, firm; many fine roots; neutral; clear wavy boundary.

A—6 to 13 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and very fine subangular blocky structure; extremely hard, firm; common fine roots; mildly alkaline; clear wavy boundary.

Bw—13 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; extremely hard, firm; common fine roots; common small intersecting slickensides; mildly alkaline; abrupt wavy boundary.

Bk1—20 to 28 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure parting to moderate fine subangular blocky; very hard, firm; common fine roots; common medium intersecting slickensides; few black (10YR 2/1) streaks along cracks; few segregations of calcium carbonate; calcareous; mildly alkaline; gradual wavy boundary.

Bk2—28 to 35 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm; few fine roots; few black (10YR 2/1) streaks along cracks; common concretions and segregations of calcium carbonate; calcareous; mildly alkaline; clear smooth boundary.

Bk3—35 to 48 inches; pale yellow (5Y 7/3) silty clay, pale olive (5Y 6/3) moist; weak fine and medium subangular blocky structure; extremely hard, very firm; few fine roots along cracks; thin gray (5Y 5/1) coatings on faces of peds; large soft powdery pipes of calcium carbonate 2 to 8 centimeters in diameter extending throughout; common medium patchy coatings of calcium carbonate on faces of peds; mildly alkaline; gradual irregular boundary.

Crk—48 to 67 inches; pale yellow (5Y 7/3) clayey tuff that crushes to silty clay loam; pale olive (5Y 6/3) moist; few olive (5Y 4/4) mottles around iron and manganese nodules; moderate thick platy structure; extremely hard, very firm; few nodules and segregations of calcium carbonate along major vertical cracks; thin patchy coatings of calcium carbonate on faces of peds; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches but is mainly 35 to 45 inches. Intersecting slickensides and pressure faces begin at a depth of 10 to 15 inches. Cycles of microdepressions and microknolls are repeated at 10- to 15-foot intervals (fig. 22). During dry periods, cracks 1 to 2 inches wide may extend as deep as the paralithic contact.

The Ap and A horizons are black, very dark gray, or dark gray. They range from neutral to moderately alkaline. The combined thickness of these horizons averages more than 12 inches in more than 50 percent of the pedons. The Ap horizon is clay or clay loam that is more than 35 percent clay.

The Bw and Bk horizons are dark gray, grayish brown, light brownish gray, gray, or pale yellow. They are clay or silty clay. They are mildly alkaline or moderately alkaline.

The Bk3 and Crk horizons are white, light gray, very pale brown, pale yellow, light brownish gray, or pale olive. The Crk horizon is clayey tuff that crushes to silty clay loam, silty clay, clay, sandy clay, or clay loam. Strata of tuffaceous sandstone or siltstone are common. These horizons have few to many carbonate coatings, nodules, and segregations.

Some of the Greenvine soils in this county are slightly deeper than is defined as the range for the series. They are 30 to 50 inches deep, whereas, the series range is 20 to 40 inches. This difference, however, does not significantly affect use and management of the soils.

Hallettsville Series

The Hallettsville series consists of gently sloping, very deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in calcareous, clayey and loamy sediments of the Goliad and Fleming Formations. Slope ranges from 1 to 3 percent. The soils are fine, montmorillonitic, thermic Udertic Paleustolls.

Typical pedon of Hallettsville fine sandy loam, 1 to 3 percent slopes; from U.S. Highway 90A in Hallettsville,

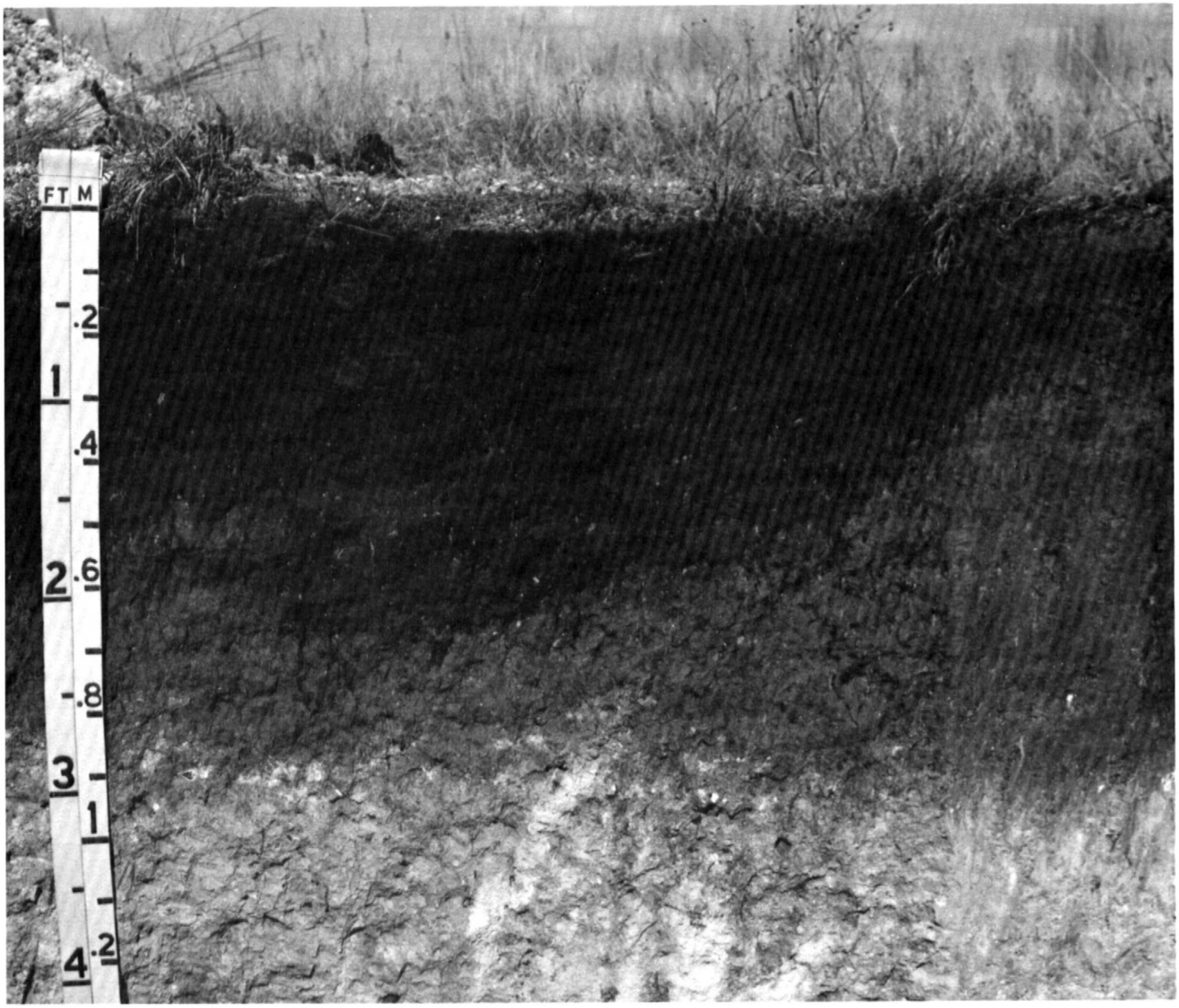

Figure 22.—Profile of Greenvine clay loam, 1 to 3 percent slopes, showing cyclic nature of the soil. The boundary between the dark colored A and Bw horizons and the lighter colored Bk1 horizon is much deeper in the depression than beneath the microknoll, which is at the right side of the photograph.

11 miles southwest on U.S. Highway 77A, about 2.75 miles southeast on Farm Road 531, about 0.45 mile northeast and 0.1 mile southeast on a gravel road, and 200 feet southwest of a road in an area of rangeland:

A—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; hard, friable; common fine, medium, and coarse roots; neutral; clear smooth boundary.

Bt1—8 to 13 inches; dark gray (10YR 4/1) sandy clay, very dark gray (10YR 3/1) moist; few faint mottles; moderate medium angular blocky structure; very hard, firm; common fine and medium roots; neutral; clear smooth boundary.

Bt2—13 to 26 inches; grayish brown (2.5Y 5/2) sandy clay, dark grayish brown (2.5Y 4/2) moist; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; very hard, firm; few fine and medium roots; few

slickensides and pressure faces; few fine black concretions; neutral; gradual wavy boundary.

Bt3—26 to 35 inches; grayish brown (2.5Y 5/2) sandy clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct light olive brown (2.5Y 5/4) mottles; strong medium angular blocky structure; very hard, firm; few fine and medium roots; few intersecting slickensides; few fine and medium pitted black concretions; few coarse concretions of calcium carbonate; neutral; gradual wavy boundary.

Btk1—35 to 45 inches; grayish brown (2.5Y 5/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse angular blocky structure; very hard, firm; few fine and medium roots; common coarse concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Btk2—45 to 54 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; few coarse distinct pale brown (10YR 6/3), common coarse prominent light gray (2.5Y 7/2), and few fine prominent red (2.5YR 4/8) mottles; moderate coarse angular blocky structure; very hard, firm; common coarse concretions of calcium carbonate; few fine black concretions and dark stains on faces of peds; calcareous; moderately alkaline; gradual wavy boundary.

2BC1—54 to 64 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; common coarse prominent brownish yellow (10YR 6/6), dark yellowish brown (10YR 4/4), and red (2.5YR 4/6) mottles; moderate medium and coarse angular blocky structure; very hard, firm; few fine soft masses of barite; few siliceous pebbles; calcareous; moderately alkaline; clear wavy boundary.

2BC2—64 to 74 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; weak coarse angular blocky structure; very hard, firm; few fine masses of barite; mildly alkaline; gradual wavy boundary.

2C—74 to 80 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; common coarse faint very pale brown (10YR 7/4) mottles; massive; very hard, very friable; few vertical clay films along cleavage planes; few medium black concretions 2 to 5 millimeters in diameter; few fine masses of barite; neutral.

The thickness of the solum ranges from 50 to more than 80 inches. The mollic epipedon is 11 to 19 inches thick. The content of clay in the control section ranges from 35 to 45 percent. The depth to secondary carbonates is 28 to about 50 inches. The 2BC and 2C horizons have more quartz, barite, and siliceous pebbles than the upper horizons.

The A horizon is dark grayish brown, very dark grayish brown, dark gray, or very dark gray. It ranges from medium acid to neutral.

The upper part of the Bt horizon is dark brown, dark gray, brown, very dark grayish brown, grayish brown, or dark grayish brown. The lower part of the Bt horizon and the Btk horizon are grayish brown, light brown, light brownish gray, brown, pale brown, light yellowish brown, yellowish brown, or brownish yellow. The Bt horizon is sandy clay or clay. The Btk horizon is sandy clay loam. The Bt and Btk horizons have common or many mottles in contrasting shades of brown or yellow. Some pedons have a mottled matrix of these colors. The combined thickness of these horizons ranges from 20 to 46 inches. The Bt horizon ranges from medium acid to mildly alkaline. The Btk horizon is mildly alkaline or moderately alkaline.

The 2BC horizon is grayish brown, white, light brownish gray, light gray, very pale brown, pale brown, or brown. It has common or many medium mottles of brown, yellow, or red. It ranges from neutral to moderately alkaline.

The 2C horizon is dark brown, brown, light brown, strong brown, reddish yellow, dark yellowish brown, light yellowish brown, brownish yellow, yellow, very pale brown, pale yellow, olive yellow, or light olive brown. Some pedons have yellow, red, or brown mottles. This horizon is fine sandy loam or sandy clay loam. It is moderately alkaline.

Inez Series

The Inez series consists of nearly level to gently sloping, very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in clayey and loamy sediments of the Lissie Formation. Slope ranges from 0 to 2 percent. The soils are fine, montmorillonitic, hyperthermic Typic Albaqualfs.

Typical pedon of Inez loamy fine sand, 0 to 2 percent slopes; from Hallettsville, 18 miles south on U.S. Highway 77, about 9.5 miles southeast on Texas Highway 111, about 4 miles north on Texana Road, and 150 feet east in an area of rangeland that supports post oak:

A—0 to 10 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grained; loose, very friable; many fine and very fine roots; slightly acid; clear smooth boundary.

E—10 to 14 inches; white (10YR 8/2) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose,

very friable; few fine roots; slightly acid; abrupt wavy boundary.

Btg1—14 to 26 inches; light gray (10YR 7/2) sandy clay, light brownish gray (10YR 6/2) moist; common fine and few medium prominent yellowish red (5YR 5/8) and reddish yellow (7.5YR 6/8) mottles; weak medium and coarse prismatic structure parting to moderate fine subangular blocky; very hard, very firm; few fine roots; common pressure faces; thin patchy clay films on faces of peds; very strongly acid; gradual wavy boundary.

Btg2—26 to 41 inches; light gray (2.5Y 7/2) sandy clay, light brownish gray (2.5Y 6/2) moist; common fine and medium prominent reddish yellow (7.5YR 6/8) and few medium prominent strong brown (7.5YR 5/8) mottles; weak medium and coarse prismatic structure parting to moderate fine subangular blocky; very hard, very firm; few fine and medium roots; common pressure faces and few small slickensides; thin patchy clay films on faces of peds; very strongly acid; gradual wavy boundary.

Btg3—41 to 53 inches; light gray (10YR 7/1) sandy clay, light gray (10YR 6/1) moist; common medium prominent yellowish red (5YR 5/8) and few medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; very hard, very firm; few fine roots; few pressure faces; thin patchy clay films on faces of peds; few fine concretions of barite; strongly acid; gradual wavy boundary.

BCg—53 to 80 inches; white (10YR 8/1) sandy clay loam, light gray (10YR 7/1) moist; few medium prominent red (2.5YR 4/8) mottles; weak coarse angular blocky structure; hard, firm; few fine concretions of barite; mildly alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The content of clay in the control section ranges from 40 to 50 percent. Many pedons have few or common concretions of barite and of iron and manganese below the A horizon.

The A horizon is light brownish gray, light gray, or grayish brown. The E horizon is white, light gray, or light brownish gray. These horizons are not mottled or have few mottles in shades of brown. They are slightly acid or neutral. The combined thickness of these horizons is 10 to 20 inches.

The Btg horizon is light gray, light brownish gray, grayish brown, or gray. It has few to many mottles in shades of red, yellow, or brown. It is sandy clay or clay. It ranges from 30 to more than 60 inches in thickness. Reaction ranges from very strongly acid to neutral.

The BCg horizon is light gray, light brownish gray, or white. It has few or common mottles in shades of red, yellow, or brown. It is clay loam, sandy clay, or sandy clay loam. Reaction ranges from neutral to moderately alkaline.

Kuy Series

The Kuy series consists of gently sloping, very deep, moderately well drained, moderately permeable soils on uplands. These soils formed in thick sandy and loamy sediments. Slope ranges from 1 to 5 percent. The soils are loamy, siliceous, hyperthermic Grossarenic Paleudalfs.

Typical pedon of Kuy loamy fine sand, 1 to 5 percent slopes; 18 miles south of Hallettsville on U.S. Highway 77, southeast on Texas Highway 111 to the Lavaca River, 0.2 mile east from the river and 300 feet north in a pasture:

A—0 to 6 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; loose, very friable; common fine roots; medium acid; clear smooth boundary.

E1—6 to 13 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; weak medium subangular blocky structure; loose, very friable; few fine roots; neutral; clear smooth boundary.

E2—13 to 52 inches; very pale brown (10YR 8/3) loamy fine sand, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure; loose, very friable; few fine roots; neutral; clear wavy boundary.

Btg—52 to 80 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium prominent reddish brown (2.5YR 4/4) and red (2.5YR 4/6) and few medium prominent reddish yellow (5YR 6/8) mottles; weak medium subangular blocky structure; very hard, firm; few fine roots; very strongly acid.

The thickness of the solum is more than 80 inches. The content of clay in the control section ranges from 20 to 35 percent.

The A and E horizons are brown, light brownish gray, pale brown, very pale brown, light brown, or pink. Some pedons have few or common brown mottles. Reaction ranges from medium acid to neutral. The combined thickness of these horizons ranges from 40 to 78 inches.

The Btg horizon is light gray, light brownish gray, strong brown, or light yellowish brown. It has common or many mottles in shades of red, yellow, brown, or gray. Reaction ranges from very strongly acid to slightly acid.

Lake Charles Series

The Lake Charles series consists of nearly level, very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in calcareous, clayey sediments of the Beaumont and Lissie Formations. Slope is 0 to 1 percent. The soils are fine, montmorillonitic, thermic Typic Pelluderts.

Typical pedon of Lake Charles clay, 0 to 1 percent slopes; from Hallettsville, 23 miles southeast on Farm Road 530 to the Speaks store, 300 feet south of the store, 0.1 mile east on a pasture road, and 100 feet north in a pasture midway between a microhigh and a microlow:

A1—0 to 12 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse prismatic structure parting to moderate medium angular blocky; very hard, very firm; common fine roots; medium acid; gradual wavy boundary.

A2—12 to 30 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; few fine prominent dark yellowish brown (10YR 3/4) mottles; strong medium angular blocky structure; extremely hard; very firm; few fine roots; medium acid; clear wavy boundary.

Bw1—30 to 53 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium angular blocky structure; extremely hard, very firm; few fine roots; common intersecting slickensides; shiny pressure faces on aggregates; mildly alkaline; gradual wavy boundary.

Bw2—53 to 62 inches; light gray (10YR 6/1) clay, gray (10YR 5/1) moist; moderate medium subangular blocky structure; extremely hard, very firm; few intersecting slickensides; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C—62 to 80 inches; very pale brown (10YR 8/4) clay, light yellowish brown (10YR 6/4) moist; massive; extremely hard, very firm; few medium soft masses of calcium carbonate; calcareous; moderately alkaline.

In undisturbed areas gilgai microknolls are 6 to 14 inches higher than microdepressions. The center of the microknolls is 5 to 11 feet from the center of the microdepressions. During dry periods, cracks 1 to 2 inches wide extend from the surface to a depth of at least 20 inches. Intersecting slickensides begin at a depth of about 20 to 30 inches.

The thickness of the A horizon ranges from 6 inches on the microknolls to 50 inches in the microdepressions. This horizon averages more than 12 inches thick in more than 60 percent of the pedons. It is dark gray, very dark gray, or black. It has a few fine black concretions in some pedons. It ranges from medium acid to mildly alkaline.

The Bw horizon is light gray, gray, or dark gray. Some pedons have streaks of lighter or darker colors or have faint brown mottles. There are a few black concretions in most pedons. The number of fine concretions of calcium carbonate ranges from none to common. This horizon is mildly alkaline or moderately alkaline. It is calcareous in some pedons.

The C horizon is gray, light gray, light brownish gray, very pale brown, or brownish yellow. The number of mottles in contrasting colors ranges from none to common. The number of fine and medium concretions of calcium carbonate also ranges from none to common. This horizon is moderately alkaline and calcareous.

Latium Series

The Latium series consists of gently sloping to strongly sloping, very deep, well drained, very slowly permeable soils on uplands. These soils formed in calcareous, clayey sediments of the Fleming Formation and Oakville Sandstone. Slope ranges from 1 to 8 percent. The soils are fine, montmorillonitic, thermic Udorthentic Chromusterts.

Typical pedon of Latium clay, 3 to 5 percent slopes, eroded; from the courthouse in Hallettsville, 11 miles north on Farm Road 957 to Moravia, 0.6 mile west on a paved county road, 0.7 mile north on a county road, and 100 feet east in a pasture:

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse granular structure; very hard, firm; common fine roots; calcareous; moderately alkaline; clear wavy boundary.

Bw—5 to 23 inches; pale yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; few faint yellow (2.5Y 7/6) mottles; moderate medium angular blocky structure; extremely hard, firm; few fine roots; common large intersecting slickensides; few fine concretions of calcium carbonate; common grayish brown streaks along cracks; calcareous; moderately alkaline; gradual wavy boundary.

Bk—23 to 44 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; common medium distinct olive yellow (2.5Y 6/6) mottles; moderate coarse angular blocky structure; extremely hard, firm; few fine roots; common large intersecting slickensides; many fine concretions of calcium carbonate; common grayish brown streaks along cracks; few fine black concretions; calcareous;

moderately alkaline; gradual wavy boundary.

CB—44 to 54 inches; pale yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; common medium distinct olive yellow (2.5Y 6/6) mottles; massive; extremely hard, firm; common intersecting slickensides at a horizontal angle of 45 degrees; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—54 to 80 inches; very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; common coarse distinct light gray (10YR 7/2) mottles; massive; extremely hard, firm; common large intersecting slickensides; few concretions of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The soils are moderately alkaline and calcareous throughout. The content of clay ranges from 45 to 60 percent. Undisturbed areas have gilgai consisting of microvalleys 1 to 3 feet wide and 2 to 8 inches deep and microridges 10 to 16 feet wide. The soils have few to many slickensides, which begin at a depth of about 8 inches and extend throughout the pedon.

The A horizon is very dark gray, dark gray, grayish brown, dark grayish brown, or very dark grayish brown. It is 3 to 9 inches thick. It averages less than 6 inches in more than 60 percent of the pedons.

The Bw, Bk, and CB horizons are grayish brown, light gray, light brownish gray, olive, olive gray, or pale yellow. Darker material is along old cracks. These horizons have few to many concretions of calcium carbonate, black concretions, and mottles.

The C horizon is light gray, light olive gray, light yellowish brown, pale yellow, pale olive, or very pale brown. It has few or many mottles in shades of brown, yellow, or gray. It has few to many concretions of calcium carbonate and black concretions.

Milby Series

The Milby series consists of nearly level to gently sloping, very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in interbedded, clayey and loamy sediments on ancient river terraces. They are mainly associated with the Lissie Formation. Slope is 0 to 3 percent. The soils are loamy, siliceous, hyperthermic Arenic Paleudalfs.

Typical pedon of Milby loamy sand, 0 to 3 percent slopes; from Hallettsville, 18 miles south on U.S. Highway 77, southeast on Texas Highway 111 to the Lavaca River, 0.7 mile east of the river, and 200 feet north in a pasture:

A—0 to 7 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist; single grained; loose, very friable; many fine roots; slightly acid; clear smooth boundary.

E1—7 to 15 inches; very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) moist; common medium distinct dark yellowish brown (10YR 4/4) mottles; single grained; loose, very friable; common fine roots; medium acid; clear smooth boundary.

E2—15 to 29 inches; very pale brown (10YR 8/4) loamy sand, light yellowish brown (10YR 6/4) moist; single grained; loose, very friable; common fine roots; slightly acid; abrupt wavy boundary.

Btg1—29 to 50 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium prominent yellowish red (5YR 5/8) and few coarse prominent red (2.5YR 4/8) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm; common fine roots; few medium black concretions; very strongly acid; diffuse wavy boundary.

Btg2—50 to 66 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many medium prominent red (2.5YR 4/6) and few fine prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; very hard, firm; few very fine roots; few medium black concretions; very strongly acid; gradual wavy boundary.

C—66 to 80 inches; reddish yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; few fine distinct red (2.5YR 5/8) and few medium prominent light brownish gray (10YR 6/2) mottles; massive; hard, friable; strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. The combined thickness of the A and E horizons is 20 to 40 inches. The content of clay in the control section ranges from 27 to 35 percent. Many pedons have black concretions in the argillic horizon.

The A and E horizons are pale brown, very pale brown, brown, or light brown. Some pedons have mottles in shades of brown or yellow. Reaction is medium acid to neutral.

The Btg or Bt horizon is light gray, light brownish gray, grayish brown, very pale brown, or brown. It has few to many mottles in shades of red, brown, or yellow. It is mainly sandy clay loam but is sandy clay in the upper few inches in some pedons. It ranges from very strongly acid to slightly acid.

The C horizon and the BC and 2C horizons, if they

occur, are light gray, reddish yellow, light brownish gray, grayish brown, gray, or white. They have few to many mottles in shades of red, gray, or brown. They are mainly sandy clay loam or clay loam but are sandy clay or clay in some pedons. They range from strongly acid to mildly alkaline.

Morales Series

The Morales series consists of nearly level, very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loamy and clayey sediments of the Lissie Formation. Slope is 0 to 1 percent. The soils are fine-loamy, siliceous, hyperthermic Aeric Glossaqualfs.

Typical pedon of Morales fine sandy loam, in an area of Morales-Cieno complex, 0 to 1 percent slopes; from Hallettsville, 17 miles south on U.S. Highway 77, about 9.5 miles southeast on Texas Highway 111, about 0.75 mile north on Texana Road, and 125 feet east in an area of rangeland:

A—0 to 4 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; common fine and few medium and coarse roots; neutral; clear smooth boundary.

E—4 to 8 inches; very pale brown (10YR 8/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; common fine faint reddish yellow (7.5YR 7/8) mottles; weak fine subangular blocky structure; slightly hard, friable; common fine and few medium and coarse roots; neutral; clear smooth boundary.

B/E—8 to 16 inches; light gray (10YR 7/2) sandy clay loam (B part), grayish brown (10YR 5/2) moist; common medium distinct brownish yellow (10YR 6/6) mottles; weak fine and medium subangular blocky structure; hard, friable; few fine and medium roots; streaks and small pockets of albic material ½ inch to 3 inches across make up about 20 percent (E part), by volume; slightly acid; abrupt smooth boundary.

Btg1—16 to 23 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; many medium prominent yellowish red (5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; very hard, friable; few fine roots; pale brown sand grains and gray clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg2—23 to 42 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many medium and coarse distinct brownish yellow (10YR 6/8) mottles; weak coarse prismatic structure parting to medium and coarse subangular blocky; very hard, firm; few pale brown sand grains and patchy clay films on faces of peds; few dark organic stains on faces of some prisms; neutral; gradual smooth boundary.

Btg3—42 to 54 inches; light gray (10YR 7/2) sandy clay loam, pale brown (10YR 6/3) moist; common fine distinct brownish yellow (10YR 6/6) and few fine prominent yellowish red (5YR 5/8) mottles; weak coarse angular blocky structure; very hard, firm; common brown sand grains on faces of peds; few fine black concretions; few fine masses of barite; moderately alkaline; gradual smooth boundary.

BC—54 to 80 inches; white (10YR 8/2) sandy clay loam, very pale brown (10YR 7/3) moist; common medium distinct yellow (10YR 7/6) and few medium prominent yellowish red (5YR 5/6) mottles; weak coarse angular blocky structure; very hard, firm; few fine black concretions; few fine and medium masses of barite; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The content of clay in the control section ranges from 25 to 35 percent. Uncoated sand grains are on faces of some peds, and they also interfinger into the upper part of the Btg horizon. The number of concretions of calcium carbonate and barite and of dark masses ranges from none to common.

The A horizon is pale brown, brown, grayish brown, or light brownish gray. It is fine sandy loam, sandy loam, or loamy fine sand. It ranges from medium acid to neutral.

The E or E/B horizon is very pale brown, pale brown, brown, or light yellowish brown. It has few or common mottles in shades of brown, red, or yellow. It is fine sandy loam or loamy fine sand. It ranges from strongly acid to neutral.

The B part of the B/E horizon is light gray, light brownish gray, pale brown, light yellowish brown, or brownish yellow. The albic material (E part) is pale brown, brown, grayish brown, light brownish gray, or light yellowish brown. This horizon has few to many mottles in shades of brown, red, or yellow. It ranges from medium acid to neutral.

The Btg horizon is light brownish gray, grayish brown, light gray, or gray. It has few to many mottles in shades of brown, red, or yellow. It is sandy clay loam, clay loam, or sandy clay. It ranges from strongly acid to neutral in the upper part and from strongly acid to moderately alkaline in the lower part. It ranges from 25 to 55 inches in thickness.

The BC horizon and the C horizon, if it occurs, are white, light gray, gray, light brownish gray, very pale

brown, or pale brown. They have few to many mottles in shades of brown, red, or yellow. They are sandy clay loam, sandy clay, or clay loam. They range from slightly acid to moderately alkaline.

Nada Series

The Nada series consists of nearly level, very deep, poorly drained, very slowly permeable soils on uplands. These soils formed in loamy sediments of the Lissie Formation. Slope is 0 to 1 percent. The soils are fine-loamy, siliceous, hyperthermic Typic Albaqualfs.

Typical pedon of Nada fine sandy loam, in an area of Nada-Cieno complex, 0 to 1 percent slopes; from Hallettsville, 26 miles south on U.S. Highway 77 to Foster Road in Victoria County, 4.5 miles east-northeast into Lavaca County to the Borcher Ranch corrals, 2.6 miles south on a ranch road, and 200 feet west in an old rice field:

Ap—0 to 7 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, friable; common fine roots; slightly acid; abrupt smooth boundary.

Btg1—7 to 26 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; few fine faint yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; very hard, firm; few fine roots; uncoated sand grains on faces of some peds; slightly acid; diffuse smooth boundary.

Btg2—26 to 41 inches; gray (10YR 5/1) sandy clay loam, dark grayish brown (10YR 4/2) moist; few fine faint brownish yellow (10YR 6/6) mottles; moderate medium angular blocky structure; very hard, firm; few fine roots; uncoated sand grains on faces of some peds; neutral; clear smooth boundary.

Btkg—41 to 49 inches; light gray (10YR 6/1) sandy clay loam, gray (10YR 5/1) moist; moderate coarse subangular blocky structure; very hard, firm; few fine and medium concretions of calcium carbonate; small pockets of uncoated sand grains; few dark stains; moderately alkaline; clear smooth boundary.

BC—49 to 80 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; common medium distinct reddish yellow (7.5YR 6/8) mottles; weak medium angular blocky structure; hard, firm; few fine white concretions of barite; common coarse lenses and pockets of uncoated sand grains; moderately alkaline.

The thickness of the solum is more than 80 inches. Uncoated sand grains on faces of peds in the Btg horizon are few or common. The average content of clay in the control section ranges from 25 to 35 percent.

The A horizon is light brownish gray or grayish brown. The number of mottles in shades of brown or yellow is few or none. This horizon is fine sandy loam or sandy loam. It ranges from medium acid to neutral.

The Btg and Btkg horizons are dark gray, gray, light gray, grayish brown, or light brownish gray. They have few or common mottles in shades of brown, yellow, or red. They are sandy clay loam, clay loam, or sandy clay. They range from medium acid to moderately alkaline. The number of calcium carbonate concretions, dark masses, and noncalcareous, white concretions ranges from none to common. The combined thickness of these horizons ranges from 30 to more than 50 inches.

The BC horizon is white, light gray, gray, or light brownish gray. It has few to many mottles in shades of red, brown, or yellow. It is sandy clay loam or clay loam. It is mildly alkaline or moderately alkaline. The number of coatings, lumps, or large pockets of sand grains ranges from few to many. The number of calcium carbonate concretions, dark stains, or white, noncalcareous concretions ranges from none to common.

Navaca Series

The Navaca series consists of nearly level, very deep, moderately well drained, very slowly permeable soils on bottom land. These soils formed in calcareous, clayey alluvium deposited over thick beds of loamy alluvial sediments. Slope ranges from 0 to 2 percent. The soils are clayey over loamy, montmorillonitic, thermic Udertic Haplustolls.

Typical pedon of Navaca clay, frequently flooded; from U.S. Highway 77 north in Hallettsville, 2 blocks west on U.S. Highway 90A, about 7.8 miles south on a county road known locally as Poorfarm Road, and 150 feet east on a flood plain on the north side of Rocky Creek:

A1—0 to 16 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak coarse blocky structure parting to moderate medium blocky; very hard, very firm; common fine, medium, and coarse roots; few pressure faces on peds; calcareous; moderately alkaline; clear wavy boundary.

A2—16 to 31 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to moderate medium blocky; very hard, very firm; common fine, medium, and coarse roots; common pressure faces; calcareous; moderately alkaline; clear wavy boundary.

2C—31 to 45 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist;

massive; slightly hard, very friable; few fine roots; calcareous; moderately alkaline; clear smooth boundary.

3C—45 to 80 inches; light yellowish brown (10YR 6/4) loamy fine sand, brown (10YR 5/3) moist; single grained; soft, very friable; calcareous; moderately alkaline.

The depth to a contrasting loamy horizon ranges from 24 to 36 inches. The upper part of the 10- to 40-inch control section is clayey. The content of clay ranges from 38 to 60 percent, and COLE values are 0.09 to 0.12. The lower part of the control section is loamy and has 25 to 35 percent less clay than the upper part.

The A horizon is very dark gray, dark gray, dark grayish brown, or very dark grayish brown. Moist values are less than 3.5. This horizon is clay or silty clay. Some pedons have a BC horizon below a depth of 16 inches. This horizon is grayish brown or light brownish gray clay or clay loam. The A and BC horizons are mildly alkaline or moderately alkaline.

The 2C and 3C horizons are grayish brown, brown, pale brown, or light yellowish brown. The 2C horizon is fine sandy loam or loam. The 3C horizon is loamy fine sand or fine sand. It is at a depth of 40 to 80 inches. It ranges from neutral to moderately alkaline. Some pedons do not have a 3C horizon.

Navidad Series

The Navidad series consists of gently sloping, very deep, well drained, moderately rapidly permeable soils on bottom land. These soils formed in sandy and loamy alluvium. Slope ranges from 1 to 3 percent. The soils are coarse-loamy, siliceous, hyperthermic Cumulic Haplustolls.

Typical pedon of Navidad fine sandy loam, occasionally flooded, 1 to 3 percent slopes; from Hallettsville, 16 miles southeast on Farm Road 530 to a ranch gate west of the Navidad River, 1 mile south on a ranch road, 0.2 mile east to an abandoned gas well location, and 150 feet north in a pasture:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

A—6 to 38 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, friable; common fine roots; neutral; gradual wavy boundary.

C1—38 to 55 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few fine roots; neutral; gradual wavy boundary.

C2—55 to 80 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; neutral.

This soil has loamy and sandy sediments more than 80 inches thick. The texture of the control section is fine sandy loam, loamy fine sand, or loam that has a weighted average content of clay less than 18 percent and more than 15 percent sand coarser than very fine sand. Some pedons have thin strata and lenses of loam, sandy clay loam, or clay loam. Reaction is neutral or mildly alkaline. Some pedons are calcareous throughout.

The A horizon is dark grayish brown, dark gray, or brown. Some pedons have few faint brownish mottles. This horizon is fine sandy loam, sandy clay loam, loam, or loamy fine sand. It ranges from 20 to 56 inches in thickness.

The C horizon is grayish brown, brown, pale brown, or light brownish gray. The number of mottles that are yellowish or brownish is few or none. This horizon ranges from fine sand to sandy clay loam. It is not stratified or has few thin strata of sandy, clayey, or loamy material.

Pulexas Series

The Pulexas series consists of nearly level, very deep, well drained, moderately rapidly permeable soils on bottom land. These soils formed in sandy and loamy alluvium of mixed origin. Slopes are dominantly less than 1 percent. The soils are coarse-loamy, siliceous, nonacid, thermic Typic Ustifluvents.

Typical pedon of Pulexas fine sandy loam, frequently flooded; from Koerth, 1.8 miles southwest on Farm Road 531, about 0.75 mile south on a gravel road to the south side of Clarks Creek Bridge, and 200 feet southeast in a pasture:

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium granular structure; soft, very friable; many fine roots; neutral; clear smooth boundary.

A2—6 to 17 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

C1—17 to 28 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; few fine roots; calcareous; moderately alkaline; clear smooth boundary.

C2—28 to 46 inches; pale brown (10YR 6/3) fine sandy

loam, brown (10YR 5/3) moist; massive; soft, very friable; few very fine roots; calcareous; moderately alkaline; gradual smooth boundary.

C3—46 to 68 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose, very friable; calcareous; moderately alkaline; gradual smooth boundary.

2C4—68 to 80 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose, very friable; many fine and medium siliceous pebbles; calcareous; moderately alkaline.

The weighted content of clay in the control section ranges from 8 to 18 percent. Stratification ranges from faintly evident to prominent.

The A horizon is brown, grayish brown, light brownish gray, or pale brown. It ranges from neutral to moderately alkaline. Some pedons are calcareous to the surface.

The C horizon is pale brown, brown, light yellowish brown, or yellowish brown. It averages fine sandy loam with strata of loamy fine sand, loamy sand, loamy coarse sand, or clay loam. Fine sand layers are below a depth of 60 inches. The number of siliceous pebbles ranges from none to many. This horizon is mildly alkaline or moderately alkaline. Most pedons are calcareous.

Pursley Series

The Pursley series consists of nearly level, very deep, well drained, moderately permeable soils on bottom land. These soils formed in calcareous, loamy alluvium. Slopes are dominantly less than 1 percent. The soils are fine-loamy, mixed, thermic Fluventic Haplustolls.

Typical pedon of Pursley loam, frequently flooded; 12 miles northeast of Hallettsville to the Shiloh Community Building, 2.25 miles east and north on an unpaved county road, 50 feet east of a road in a pasture on a flood plain of Big Rocky Creek, 0.25 mile north of the Brown Chapel Church:

A—0 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; many coarse and medium roots; calcareous; moderately alkaline; clear smooth boundary.

C1—16 to 29 inches; light brownish gray (10YR 6/2) loam, brown (10YR 5/3) moist; massive; hard, friable; few coarse and medium roots; calcareous; moderately alkaline; clear smooth boundary.

C2—29 to 57 inches; pale brown (10YR 6/3) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C3—57 to 62 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grained; soft, very friable; calcareous; moderately alkaline; clear smooth boundary.

C4—62 to 80 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The 10- to 40-inch control section is loam or sandy clay loam that has thin strata of loamy fine sand, fine sandy loam, or sandy clay. The content of silicate clay is 18 to 35 percent. Some pedons have a few black concretions. The mollic epipedon is 10 to 20 inches thick.

The A horizon is dark grayish brown, grayish brown, dark gray, or very dark gray. It is loam or clay loam. It may or may not be calcareous and is moderately alkaline or mildly alkaline.

The B horizon, if it occurs, and the upper part of the C horizon are light brownish gray, grayish brown, pale brown, brown, or yellowish brown. They are clay loam or loam, but fine sandy loam or strata of sandy clay are in some pedons. Thin, light colored, sandy strata are common in most pedons.

The lower part of the C horizon, generally below a depth of 50 inches, is mostly lighter textured than the overlying horizons and commonly has strata of varying textures.

Straber Series

The Straber series consists of nearly level to gently sloping, very deep, somewhat poorly drained, very slowly permeable soils on uplands (fig. 23). These soils formed in sandy and loamy sediments of the Willis Formation. Slope ranges from 1 to 8 percent. The soils are fine, mixed, thermic Aquic Paleustalfs.

Typical pedon of Straber loamy sand, 1 to 5 percent slopes; from the courthouse in Hallettsville, 1 mile east on U.S. Highway 90A, about 12.5 miles southeast on Farm Road 530, about 2.07 miles west on a county road, 0.15 mile northwest on a ranch road, and 100 feet north in an area of rangeland:

A—0 to 7 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; loose, very friable; common fine and few coarse roots; medium acid; clear wavy boundary.

E—7 to 14 inches; very pale brown (10YR 7/3) loamy sand, light yellowish brown (10YR 6/4) moist; single

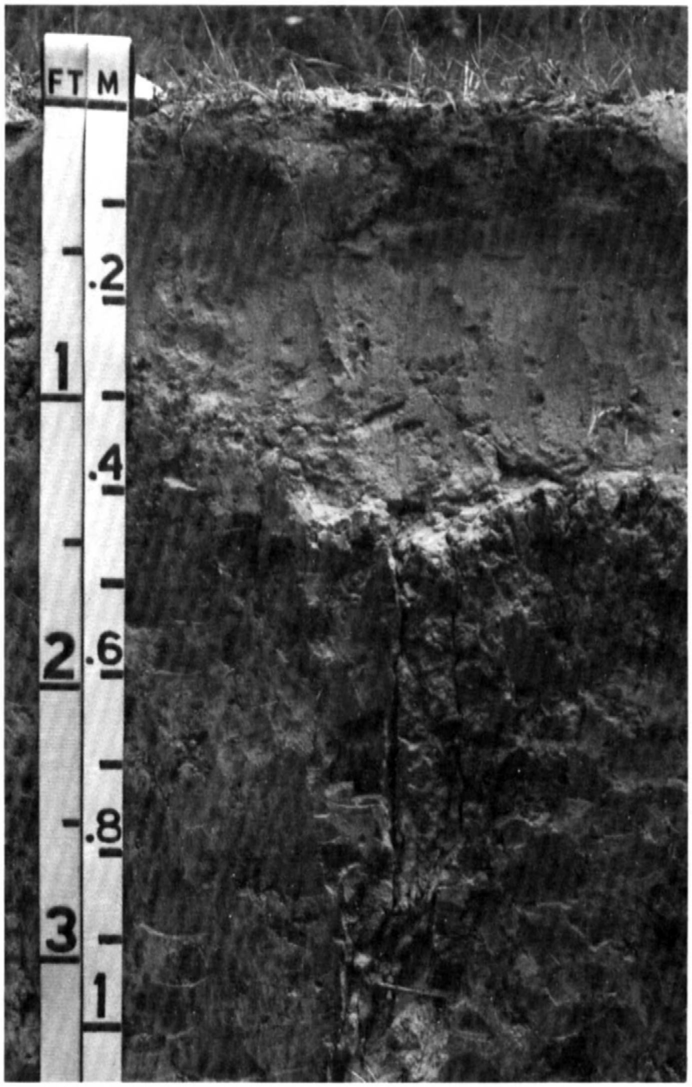

Figure 23.—Profile of Straber loamy sand, 1 to 5 percent slopes. A very pale brown subsurface layer is between depths of 7 and 14 inches.

grained; loose, very friable; few fine, medium, and coarse roots; neutral; abrupt wavy boundary.

Bt1—14 to 23 inches; brownish yellow (10YR 6/8) clay, yellowish brown (10YR 5/8) moist; common fine and medium prominent grayish brown (10YR 5/2) and few fine prominent red (2.5YR 4/8) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; extremely hard, very firm; few fine, medium, and coarse roots; common pressure faces and few small slickensides; many clay films on faces of peds; few clean sand coatings on faces of peds; strongly acid; gradual wavy boundary.

Bt2—23 to 34 inches; reddish yellow (7.5YR 6/8) sandy clay, strong brown (7.5YR 5/8) moist; few fine and medium prominent grayish brown (10YR 5/2) and few fine prominent red (2.5YR 4/8) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; extremely hard, very firm; few fine, medium, and coarse roots; common pressure faces and few slickensides; many clay films on faces of peds; few clean sand coatings on faces of peds; few medium black concretions; strongly acid; gradual wavy boundary.

Btg—34 to 52 inches; light gray (10YR 7/2) sandy clay, light brownish gray (10YR 6/2) moist; common medium and coarse prominent reddish yellow (7.5YR 6/8) and few fine prominent red (2.5YR 4/8) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; extremely hard, very firm; few fine roots; common pressure faces and few slickensides; many clay films on faces of peds; few clean sand coatings on faces of peds; few medium black concretions and few fine noncalcareous white masses; strongly acid; gradual wavy boundary.

BCg—52 to 62 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; common fine and medium prominent strong brown (7.5YR 5/8) and yellowish red (5YR 5/8) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very hard, very firm; few fine and medium roots; few fine siliceous pebbles; few clean sand coatings on faces of peds and very few vertically oriented pockets of clean sand 5 to 10 millimeters wide and 2 to 6 centimeters long; few medium black concretions; many fine noncalcareous white masses; slightly acid; gradual wavy boundary.

Cg—62 to 80 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; few fine prominent brownish yellow (10YR 6/8) and strong brown (7.5YR 5/8) mottles; massive; very hard, firm; few fine and medium roots; few fine siliceous pebbles; few clay films along cleavage planes; few soft masses of calcium carbonate; few fine noncalcareous white masses; slightly acid.

The thickness of the solum ranges from 40 to 70 inches. The control section is sandy clay or clay and has an average content of clay that ranges from 40 to 50 percent. The number of siliceous pebbles and black concretions is 0 to 10 percent, by volume.

The A and E horizons are brown, light brown, pale brown, very pale brown, yellowish brown, or light brownish gray. Some pedons are mottled in the E horizon with contrasting colors. The combined thickness of these horizons is 10 to 20 inches. Reaction ranges from strongly acid to neutral.

The Bt horizon is light gray, light brownish gray, pale brown, brownish yellow, reddish yellow, light yellowish brown, grayish brown, or strong brown. Mottles are in shades of gray, brown, yellow, or red. This horizon is sandy clay or clay. It is strongly acid or medium acid. It is 25 to 55 inches thick.

The BCg horizon, if it occurs, is light brownish gray, light gray, or dark grayish brown. Mottles are in shades of brown, yellow, or red. This horizon is sandy clay loam or sandy clay. It ranges from strongly acid to mildly alkaline. The number of calcium carbonate concretions is none or few. This horizon is as much as 20 inches thick.

The Cg horizon is light gray or light brownish gray. Mottles are in shades of red or brown. This horizon generally is sandy clay loam or sandy clay but ranges to loamy fine sand. It ranges from very strongly acid to moderately alkaline. The number of calcium carbonate concretions ranges from none to common.

Telferner Series

The Telferner series consists of nearly level, very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in calcareous, clayey and loamy sediments of the Lissie Formation. Slopes are dominantly less than 1 percent. The soils are fine, montmorillonitic, hyperthermic Typic Albaqualfs.

Typical pedon of Telferner fine sandy loam, 0 to 1 percent slopes; from Hallettsville, 26 miles south on U.S. Highway 77 to Foster Road in Victoria County, 2.4 miles east-northeast into Lavaca County, and 100 feet south in a pasture; 0.2 mile inside the Lavaca County line:

A—0 to 14 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, friable; many very fine and fine roots; few fine and medium siliceous pebbles; neutral; abrupt wavy boundary.

Btg1—14 to 19 inches; grayish brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; common fine prominent yellowish red (5YR 5/8) mottles; moderate medium and coarse angular blocky structure; extremely hard, firm; common fine roots; few fine and medium siliceous pebbles; slightly acid; clear wavy boundary.

Btg2—19 to 27 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; many medium prominent brownish yellow (7.5YR 5/8) mottles; moderate medium and coarse angular blocky structure; extremely hard, firm; few fine roots; few fine siliceous pebbles; few very fine concretions of barite; slightly acid; clear wavy boundary.

Btg3—27 to 33 inches; light brownish gray (2.5Y 6/2) sandy clay, grayish brown (2.5Y 5/2) moist; common medium prominent brownish yellow (10YR 6/8) mottles; moderate medium and coarse subangular blocky structure; extremely hard, firm; few fine roots; few concretions of barite; few siliceous pebbles; neutral; gradual wavy boundary.

Btg4—33 to 46 inches; light brownish gray (2.5Y 6/2) sandy clay, grayish brown (2.5Y 5/2) moist; common medium prominent brownish yellow (10YR 6/8) mottles; moderate coarse subangular blocky structure; extremely hard, firm; few concretions of calcium carbonate and barite; few black concretions; few siliceous pebbles; calcareous; moderately alkaline; clear smooth boundary.

BCk—46 to 70 inches; light gray (2.5Y 7/2) sandy clay loam, light yellowish brown (2.5Y 6/4) moist; moderate medium and coarse subangular blocky structure; hard, friable; common very fine concretions and films of calcium carbonate; few black concretions; few fine siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.

Ck—70 to 80 inches; white (2.5Y 8/2) clay loam, light gray (2.5Y 7/2) moist; pockets of pale yellow (2.5Y 7/4) sandy clay loam; massive; very hard, firm; common lumps and concretions of calcium carbonate; few fine black concretions; few siliceous pebbles; calcareous; moderately alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The number of siliceous pebbles is none or few. The number of dark concretions is none or few throughout. The combined thickness of the A and E horizons ranges from 10 to 20 inches.

The A horizon is grayish brown or light brownish gray. It is not mottled or has few to many mottles in contrasting colors. It is slightly acid or neutral.

The E horizon, if it occurs, is light gray. It is not mottled or has few to many mottles in contrasting colors. It is slightly acid or neutral.

The Btg horizon is grayish brown, light brownish gray, or light gray. It has common or many mottles in shades of red, yellow, or brown. This horizon is sandy clay, clay, or clay loam. It ranges from slightly acid to moderately alkaline. It is 26 to 52 inches thick.

The BCk and Ck horizons are white, light gray, or very pale brown. They are sandy clay loam, sandy clay, or clay loam. The number of calcium carbonate concretions ranges from none to many. Reaction is mildly alkaline or moderately alkaline.

Tremona Series

The Tremona series consists of gently sloping, very deep, somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in interbedded, sandy and loamy sediments of the Willis Formation. Slope ranges from 1 to 5 percent. The soils are clayey, mixed, thermic Aquic Arenic Paleustalfs.

Typical pedon of Tremona loamy fine sand, 1 to 5 percent slopes; from Hallettsville, 10.5 miles east on U.S. Highway 90A past Sublime, 5.4 miles south on a county road, and 50 feet west in an area of rangeland that supports post oak:

A—0 to 7 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grained; loose, very friable; many medium and fine roots; slightly acid; gradual smooth boundary.

E—7 to 27 inches; very pale brown (10YR 8/3) loamy fine sand, very pale brown (10YR 7/4) moist; single grained; loose, very friable; many medium and fine roots; slightly acid; abrupt wavy boundary.

Btg1—27 to 35 inches; light gray (10YR 6/1) sandy clay, gray (10YR 5/1) moist; many coarse prominent reddish yellow (7.5YR 7/8) and dusky red (10R 3/4) mottles; moderate medium blocky structure; extremely hard, firm; few fine roots; few soft masses of barite; strongly acid; gradual wavy boundary.

Btg2—35 to 47 inches; light gray (10YR 7/1) sandy clay, light gray (10YR 6/1) moist; common medium prominent reddish yellow (7.5YR 7/8) and common coarse prominent dusky red (10R 3/4) mottles; moderate medium blocky structure; extremely hard, firm; strongly acid; gradual wavy boundary.

Btg3—47 to 61 inches; light gray (10YR 7/1) sandy clay, light gray (10YR 6/1) moist; few medium prominent reddish yellow (7.5YR 7/8) and many coarse prominent dusky red (10R 3/4) mottles; moderate coarse blocky structure; very hard, firm; strongly acid; gradual wavy boundary.

BC—61 to 80 inches; light gray (10YR 7/1) sandy clay loam, light gray (10YR 6/1) moist; common medium prominent reddish yellow (7.5YR 7/8) and many coarse prominent dusky red (10R 3/4) mottles; weak coarse blocky structure; hard, friable; strongly acid.

The thickness of the solum ranges from 60 to more than 80 inches. Some pedons contain varying amounts of siliceous pebbles that decrease in number with increasing depth.

The A and E horizons are 20 to 40 inches thick. They are brown, grayish brown, pale brown, light brownish gray, light gray, or very pale brown. They are medium acid or slightly acid.

The Btg horizon is light gray, light brownish gray, grayish brown, or gray. Mottles are in shades of red, yellow, or brown. This horizon is sandy clay or clay. It is strongly acid or medium acid. It is 22 to 48 inches thick.

The BC horizon is light gray, gray, light brownish gray, grayish brown, or brown. Mottles are in shades of red, yellow, or brown. This horizon is sandy clay loam, sandy clay, or clay. It is very strongly acid or medium acid.

The C horizon, if it occurs within a depth of 80 inches, is very pale brown, light brownish gray, light gray, or gray. It is sandy clay, clay, clay loam, or sandy clay loam.

Formation of the Soils

In this section the factors of soil formation are related to the soils in Lavaca County. Also, the processes of horizon differentiation and surface geology are described.

Factors of Soil Formation

Soil is a three-dimensional body on the Earth's surface that supports plants. Soil properties result from the parent material and from additions, removals, transfers, and transformations to the soil caused by climate, living organisms, topography, and time. Human activities are also important.

The interaction of the five soil-forming factors results in differences among the soils. Climate and plants and animals are the active factors. They act on the parent material by influencing the weathering of rocks and through subsequent transportation of the material by water and wind. They slowly change the parent material into a natural body with genetically related horizons. The effects of climate and plants and animals are influenced by the topography. Soils on flood plains, for example, are quite different from those on well drained uplands. The parent material also affects the kind of profile that can form and sometimes determines it entirely. Finally, time is needed to change parent material into soil. Generally, a long time is needed for distinct horizons to form.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the chemical and mineralogical composition of the soil. In Lavaca County, the soils formed in material from several geological systems ranging from Recent to Eocene.

Straber and Tremona soils formed in loamy material, which permits moderate water movement. These soils have clay-enriched horizons that contain concretions of iron. Frelsburg and Bleiblerville soils formed in calcareous, clay material. The churning of this clay prevents differentiation of horizons. The parent material of the soils in the survey area is described in more detail in the section "Surface Geology."

Climate

The climate in the county has been humid during the time that the soils in the county have formed. It promotes moderately rapid soil development. The climate is uniform throughout the survey area, but its effect is modified locally by runoff. In some areas the effect also is modified by the direction of exposure. Major differences among soils in this area are not believed to have resulted from the climate.

Living Organisms

Plants, micro-organisms, earthworms, crawfish, and other living organisms have contributed to the development of soils. The addition of organic matter and nitrogen to the soil, the addition and removal of plant nutrients, and changes in structure and porosity are caused by plants and animals.

Plants, dominantly tall and mid grasses, have affected soil formation in Lavaca County more than animals have. Prairie climax vegetation has contributed significantly to the accumulated organic matter, which has resulted in the darkening of the surface layer in Bleiblerville, Carbengle, Lake Charles, Cuero, and many other soils. Straber, Tremona, and Dutek soils, however, generally have a low content of organic matter because they formed under trees.

Topography

Topography, or relief, affects soil formation through its influence on drainage, erosion, the plant cover, and soil temperature. The topography of the county ranges from nearly level in the south to gently rolling in the north.

The degree of profile development often depends on the amount of moisture in the soil. Cieno soils are in depressions that receive extra water; therefore, they have developed gleyed characteristics. Because these soils are poorly drained and wet, horizonation is degraded. The more sloping Dutek soils are better drained and have brighter colors and distinct horizons throughout. Soils on foot slopes, such as Cuero soils, receive additional organic material and have a thick,

dark surface layer. Soils on hillsides, such as Latium soils, have a thin surface layer because the surface layer is removed by erosion as quickly as it is developed.

Time

A great length of time is usually required for the formation of soils with distinct horizons. The differences in the length of time that the parent material has been in place are generally reflected in the degree of development of soil horizons. The soils in Lavaca County range from young to old. Navidad and Pulexas soils on flood plains are young soils. They have undergone little horizon development. Except for a darkening of the surface layer, they closely resemble the parent material. Straber and Tremona soils are older soils. They have developed distinct horizons that do not resemble the parent material.

Processes of Horizon Differentiation

Several processes are involved in the formation of horizons in soils. These processes include accumulation of organic matter, leaching of carbonates and other bases, reduction and transfer of iron, and formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

The accumulation of organic matter in the upper part of a profile results in the formation of a distinct dark surface layer. The soils in Lavaca County range from low to moderate in content of organic matter. Carbengle, Cuero, and Bleiblerville soils have accumulated organic matter and have a dark surface layer.

Carbonates have been leached downward in many of the soils in this area. Much leaching has occurred in Straber and Tremona soils, but little has occurred in Carbengle and Latium soils, which are still high in carbonates.

The reduction and transfer of iron, a process called gleying, is evident in poorly drained and somewhat poorly drained soils. Gray colors in the lower layers of Edna and Cieno soils indicate reduction and loss of iron. Yellowish brown, strong brown, and reddish brown mottles and concretions in some horizons indicate segregation of iron. Straber and Tremona soils have such mottles.

The translocation of clay minerals has also contributed to horizon development in many soils. Clay minerals are produced by weathering of primary minerals. The subsoil in many soils has accumulations of clay (films) in pores and on peds. These soils were probably leached of carbonates and bases before the translocation of silicate clay took place. A horizon with accumulations of translocated clay is called an argillic horizon. Straber soils, for example, have an argillic horizon.

Surface Geology

Saul Aronow, Department of Geology, Lamar University, Beaumont, Texas, prepared this section.

Lavaca County lies in the West Gulf Coast subdivision of the Atlantic and Gulf Plains geomorphic unit *(14)*. The surface formations, other than alluvium and associated terrace deposits, range in age from Eocene (Whitsett Formation of the Jackson Group) to Pleistocene (Lissie Formation). These formations crop out in bands that are parallel to the gulf and that dip gently towards the gulf. These dips are less than 2 degrees, or about 185 feet per mile. The oldest rocks are in the northwestern part of the county, and the youngest are in the southeastern part. The terrace and alluvial deposits are Pleistocene to Holocene in age.

The county is drained by the Navidad and Lavaca Rivers and their tributaries, which flow southeastward.

The geology of all or part of the county has been depicted on several geologic maps *(16, 30)*. The "Geologic Atlas of Texas, Sequin Sheet" is the principal reference in this section.

The general soil map of the county serves as a starting point in correlating the soils and the geologic units.

Whitsett and Catahoula Formations

The Whitsett Formation, the oldest in the county, and the Catahoula Formation, the next oldest, both crop out in the Greenvine-Flatonia general soil map unit. The Whitsett Formation is the uppermost formation in the Jackson Group of late Eocene age. The Catahoula Formation is late Oligocene to early Miocene in age.

Both units contain volcanic ash and smectitic clay derived from volcanic ash. The ash has been fluvially reworked, mass-wasted, and weathered since its initial occurrence. It may have originated in West Texas or northern Mexico. Silica, released into ground water by the weathering of the ash, has replaced or permeated woody vegetation, producing petrified wood, especially in the Catahoula Formation.

Both the Whitsett and Catahoula Formations are fluvial in origin and contain several common fluvial facies. These facies include sandy channel and point-bar deposits and clayey and silty overbank deposits, including levee, crevasse splay, and flood basin deposits. The formations are regressive or prograding units. They represent a seaward extension or building out of the paleoshorelines, and they override previously

deposited nearshore marine sediments of the older formations of the Jackson Group. The deltaic, littoral, and shallow marine parts of the Whitsett and Catahoula Formations are buried in the subsurface towards the gulf *(8, 10)*.

Of the soils in the Greenvine-Flatonia general soil map unit, the Carbengle soils have the most consistently sandy parent material, which is probably of point-bar and channel origin. The parent material of the other principal soils in the map unit covers a wide range of lithologies from clays to thin sandstone beds. This range suggests overbank origins, such as flood basin, levee, crevasse splay, and oxbow lake fillings *(10)*.

Most of the soils that developed in these formations are calcareous; however, similar soils and sediments of the Whitsett and Catahoula Formations are largely devoid of calcareous materials in the northern Gulf Coast counties of Texas, for example, Jasper, Newton, Polk, and Angelina Counties. The absence of calcareous material probably reflects the promotion of solution under conditions of higher rainfall, both during the present time and in the past. Alternatively, the higher content of calcareous material may reflect that sources of Cretaceous limestone are closer to central and southern Texas Gulf Coast streams *(17)*.

Oakville Sandstone Formation

The Oakville Sandstone Formation unconformably overlies the Catahoula Formation and is Miocene in age. Earlier, it and the overlying, younger Fleming Formation were assigned to a Fleming Group, in which the Fleming Formation was referred to as the Lagarto Formation *(16)*. This terminology has been recently revived *(11, 12)*.

To the northeast, outside the county, in the vicinity of the Brazos River, the Oakville Sandstone Formation is indistinguishable from the more sandy sediment in the lower part of the Fleming Formation. It is not included as a formation in that area *(17, 28)*.

Part of the Oakville Sandstone Formation in Lavaca County has been regionally designated as the "Moulton Streamplain" *(12)*. This area, though sandier than the overlying Fleming Formation, has a higher content of clay than the adjacent contemporaneous depositional subunits. The Oakville Sandstone Formation was deposited by mixed-load streams. Locally these streams were probably the paleo-Lavaca and paleo-Navidad, which laid down sandy channel and point-bar deposits and clayey and silty overbank deposits, expressed as calcite-cemented, cross-bedded sandstones and calcareous clays and silts, respectively.

The Moulton Sandstone member of the Oakville Sandstone Formation is about mid-Oakville Sandstone in stratigraphic position *(18)*. It is adjacent to the part of the Lavaca River that flows eastward between Moulton and Breslau. The northern side of the valley is the gently sloping dip surface. The southern side is more steeply sloping and is a cuesta held up by the resistant Moulton Sandstone. The basal part of the Moulton Sandstone caps Frederick Mound, also known as the Burkett Mound *(18)*, in an area northwest of Moulton.

The Oakville Sandstone Formation falls mostly within the Carbengle-Frelsburg general soil map unit. Carbengle, a major soil, and Cuero, a minor soil, are underlain by sandstone that is probably point bar and channel in origin. Frelsburg, the other major soil, and Bleiblerville, another minor soil, are underlain by clayey, silty, and sandy substrates of overbank origin, such as levee, crevasse splay, and flood basin.

Fleming Formation

The Fleming Formation, like the Oakville Sandstone Formation, is Miocene in age, fluvial in origin, and contains cross-bedded, calcite-cemented sandstone. It conformably overlies the Oakville Sandstone Formation. In the vicinity of the Brazos River in Washington County, the lower, or older part, of the Fleming Formation merges with the Oakville Sandstone Formation, which loses its sandy lithologic identity. This merger suggests a regional change in the type of fluvial sedimentation.

The outcrop areas of the Fleming Formation and the next younger formation, the Goliad Formation, are overlain by several general soil map units. The northern boundary, or basal part, of the Fleming Formation occurs within the Carbengle-Frelsburg general soil map unit. The southern boundary, or upper part, occurs within both the Denhawken-Elmendorf-Hallettsville and Straber-Tremona general soil map units. Virtually all of the Dubina-Hallettsville-Straber general soil map unit lies within the Fleming Formation outcrop area.

The transitional, conformal contact of the Fleming Formation and the Oakville Sandstone Formation within the Carbengle-Frelsburg general soil map unit seems to mark a gradual change from deposits in the Oakville Sandstone Formation by mixed-load streams that have greater amounts of channel and point-bar sandstones to deposits in the Fleming Formation by streams richer in overbank silts and clays, such as flood basin, levee, and crevasse splay. The best exposure of cross-bedded, calcite-cemented sandstone in the county is located in a Fleming Formation outcrop in a quarry on Farm Road 957 about 4 miles northwest of Hallettsville. The clayey substrates of the Denhawken and Elmendorf soils replace the Frelsburg soils as the soil overlying the finer grained overbank material. Some areas of the

Hallettsville soils may represent the coarser grained channel and point-bar facies of the Fleming Formation.

The multisoil character of the Fleming Formation outcrop may be understood in terms of the limitations of the geologic mapping. Part of the outcrop area is covered with patchy discontinuous outcrops and residua of younger formations. No discontinuity is identified in the profile descriptions of the Denhawken and Elmendorf soils; however, the sandy upper part of the profiles, many with siliceous pebbles, is probably the residua of the younger gravelly Goliad Formation or the Willis Formation. The surface area of the Dubina-Hallettsville-Straber general soil map unit, though not described in the profile descriptions, contains some scattered siliceous pebbles. Whether the Dubina and Hallettsville soils developed in unidentified, unmapped areas of the Goliad Formation is unclear. The Straber and Tremona soils probably developed in areas of the Willis Formation. The scale of the geologic map and the size, number, and thickness of the outcrops determine whether or not various formations are included on the map.

The Denhawken and Elmendorf soils are not unique to the Fleming and Goliad Formations. They also occur on the shallow-water marine Cook Mountain Formation of Eocene age in nearby Gonzales and Wilson Counties *(13)*.

Goliad Formation

The Goliad Formation is of Pliocene age and overlies the Fleming Formation. The outcrop area mainly includes two general soil map units, the Denhawken-Elmendorf-Hallettsville and the Straber-Tremona general soil map units *(30)*. Denhawken, Elmendorf, Hallettsville, and Dubina soils most likely are located in areas of the Goliad Formation, and Straber and Tremona soils are in areas of the Willis Formation.

The Goliad Formation outcrop area in Texas reaches its northernmost extent in Lavaca County and terminates abruptly at the Colorado County boundary northeast of the Navidad River. A few small, isolated, and possibly doubtful outcrops have been noted to the north in Colorado, Austin, and Fort Bend Counties *(33)*. The assumed increase in solution of caliche in the Goliad Formation in the northeasterly direction of higher rainfall or the absence of caliche in that direction makes surface recognition difficult. To the south, the Goliad Formation continues in Texas to the flood plain of the Rio Grande in Hidalgo and Starr Counties *(29)*.

The fluvial origin of the Goliad Formation *(1)* is indicated by the many exposures of calcite-cemented, cross-bedded sandstones and conglomerates. The exposures mainly occur outside Lavaca County. They are mostly siliceous and cherty, subrounded to well rounded pebbles of point-bar and channel origin and calcareous clays and silts of overbank origin. The Goliad Formation is almost uniformly calcareous. Much of the outcrop area outside the county is capped with caliche deposits, probably almost contemporaneous with the deposition of the formation. In some deep caliche pits outside of the county, cross-bedded, angular detrital caliche can be observed. The presence of this caliche suggests erosion of surface caliche within the drainage basin of the streams that deposited sediment in the Goliad Formation. Some good exposures of the Goliad Formation caliche and fluvial deposits can be seen in a pit where Poor Farm Road crosses Rocky Creek about 4 miles northwest of Ezzell and in a streamcut of a small tributary to Rocky Creek about a mile southwest of the pit.

In Lavaca County, the small number of outcrops and the lack of a calcic or a petrocalcic horizon in any soil within the mapped outcrop area limit available knowledge of the Goliad Formation. A few siliceous pebbles in the Denhawken and Elmendorf soils, scattered pebbles on the surface in the Dubina-Hallettsville-Straber general soil map unit, and possibly the parent material of the Dubina and Hallettsville soils may be the major expressions of this formation. The interconnected delineations of the Straber and Tremona soils in the outcrop area probably represent a Willis Formation fluvial pattern surrounding isolated inliers of the Goliad Formation.

The mapping of the Goliad Formation shown on the Sequin atlas sheet is in need of reevaluation. Confusion exists about the outcrop area of the Goliad Formation and its relationship to the overlying Willis Formation. Thus, one of the earliest maps of the Goliad Formation outcrop area in south Texas interchanges the relative positions of the Goliad Formation and the equivalent of the Willis Formation *(16)*. It places the Willis Formation outcrop northwest of that of the Goliad Formation. A more recent study suggests that the Willis Formation is a weathered, locally reworked, early Pleistocene residuum derived from the upper surface of the Goliad Formation and not a younger fluvial deposit whose source areas lie north of the Goliad Formation outcrop *(31, 32)*.

Willis Formation

The Willis Formation overlies the Goliad Formation. It is fluvial in origin *(1)*. The Willis Formation outcrop area includes most of the Straber-Tremona general soil map unit and a small part of the Telferner general soil map unit in the southernmost tip of the county. Soils that developed in areas of the Willis Formation include the

Straber, Tremona, and Catilla soils of the Straber-Tremona general soil map unit and the Fordtran and Inez soils of the Telferner general soil map unit.

The age of the Willis Formation has been disputed. Suggestions of its age have ranged from Pliocene, Plio-Pleistocene, pre-glacial Pleistocene, to Pleistocene. A pre-glacial time of deposition seems likely because the Citronelle Formation in Louisiana, Mississippi, Alabama, and western Florida interfingers with fossiliferous marine sediments that are most likely Plio-Pleistocene, or about 2.6 to 3 million years before the present *(15, 19)*. The Citronelle Formation is the eastern correlative of the Willis Formation. If the Willis Formation is included in the glacial Pleistocene, deposition is assumed to have been controlled by glacially induced eustatic sea level changes.

The Willis Formation has been identified in other counties by bedding associated with fluvial origin; the presence of sand to coarse gravel; a surface layer of iron-oxide cemented sand and gravel 3 to 15 feet thick; clays and silts that have red, yellow, and brown mottles; plinthitic horizons; and soils rich in iron-oxide concretions. In most of Lavaca County only a few of these criteria are met, but the continuity of outcrops down the coast and stratigraphic position indicate that the Willis Formation occurs in the county. One of the few exposures of the Willis Formation in the county that seems to match the preceding criteria is located in what may be among the largest gravel pits in the county. The pits are about 0.5 mile south of State Highway 111 between the Lavaca River and Andrews Branch of Boggy Creek.

Straber, Tremona, and Catilla soils and their parent material match some of the mapping criteria, such as soil texture, mottling, and siliceous gravel. Straber soils that have, in some pedons, alkaline reactions and concretions of calcium carbonate in the C horizon seem to be the only exception. These soils are probably thin outcrops of the Willis Formation that overlie older, calcareous formations. A good surface exposure of this sequence can be seen on the south side of a road about 4 miles southeast of the intersection of Farm Roads 318 and 2543, where the Willis Formation gravel is overlying the calcareous Goliad Formation sandstone.

The Willis Formation has been variously interpreted as deposits of braided streams that are coarse grained and gravelly and as coarse grained meander belt deposits *(1)*. This interpretation may be true for areas of the Willis Formation outside the county, but Lavaca County lacks coarse gravelly deposits. The few gravelly areas of the Willis Formation in the county are more likely the products of mixed-load meandering streams that have the gravel as channel deposits or as the basal part of point-bar deposits.

Lissie Formation

The Lissie Formation overlies the Willis Formation. It is probably of Middle Pleistocene age and is fluvial in origin. It includes most of the Inez-Morales-Cieno and Telferner general soil map units.

The Lissie Formation is topographically separated from the underlying Willis Formation by a poorly defined to well defined contact, which rises about 20 feet in 0.2 to 0.5 of a mile where the contact is not along a river or other drainageway. The flatter surface of the Lissie Formation has many poorly drained areas and circular, undrained depressions in contrast to the comparatively well dissected, rounded slopes of the Willis Formation.

The deposition of the Lissie Formation and younger Pleistocene units outside the county was controlled by changes in sea level as ice advanced and retreated during several worldwide continental glaciations *(4, 5)*. The Lissie Formation was probably deposited during a high interglacial sea level similar to the present. During the periods of ice advance, the sea level was lowered as water was abstracted from the oceans and transferred to the continents as glaciers. Some maps of the Lissie Formation outcrop area in other parts of Texas have divided the Lissie Formation into two units *(26, 27)*. These units are the older Bentley Formation and the younger Montgomery Formation. Each of these formations was deposited in response to glacially controlled sea level changes.

The soils in the Inez-Morales-Cieno and Telferner general soil map units range from the gravelly Telferner soils to the clayey Lake Charles soils. This variety of soils may reflect lateral facies changes in a fluvial environment from sandy and gravelly channel and point-bar deposits to clayey flood basin deposits, respectively. Some of these textural differences, however, more likely are related to large-scale changes in fluvial flow regimens during at least two episodes of deposition controlled by sea level during the Pleistocene.

The Lissie Formation is dissected by Chicolete Creek in the Telferner general soil map unit in the southernmost part of the county. The dissected part and a great variety of slopes are in an area of the Lissie Formation that is not clearly differentiated topographically from the Willis Formation but that is underlain by soils characteristic of the flatter areas. The Willis Formation and two parts of the Lissie Formation may be present in these areas.

The origin of the undrained depressions, which are the sites of Cieno soils, is of interest because it identifies the problems of modifying fluvial depositional surfaces of low relief and the accompanying development of soils. These depressions are similar in

size and depth but lack the alignment of the flatwoods ponds of East Texas.

Younger Pleistocene formations, exposed to the southeast in Jackson County, have a relict depositional topography on which distinct areas of flood basin and meander-ridge origin can be discerned. The surface of the Lissie Formation has been scarcely dissected in many places, but a real or surface fluvial facies cannot be readily delineated. Extensive wind modification of the surface of the Lissie Formation during dryer episodes of the Pleistocene and Holocene may have caused the loss of surface detail.

The shallow, undrained depressions on flat Pleistocene surfaces may have originated as wind deflation hollows, or blowouts; segmented and nearly filled fluvial channels, oxbows, and swales on point-bar surfaces by local mass-wasting *(9)*; or subsidence resulting from solution or erosion of subsurface materials (piping). The lack of surface relief for the development of hydraulic gradients and the lack of soluble subsurface materials would tend to eliminate subsidence. The gradual lateral transport of surface materials by wind and mass-wasting and localized intensive deflation would tend to lead to the random and nonaligned patterns of depressions seen on the surface of the Lissie Formation.

The small size of the hollows and their shallow character seem to preclude the preservation of a rim of wind-deflated material. Probably the contents of the depressions have been scattered and incorporated into the sandy and loamy surface horizons of the soils on the surface of the Lissie Formation.

The presence of a mature soil, an Ochraqualf, in the depressions and the absence of a rim of wind-excavated material around the depressions suggests that the depressions are in a stage of filling rather than deflating. The depressions are probably being filled slowly by locally derived, overland-flow material transported from the surface layer of adjacent soils.

Pleistocene Terraces, Holocene Flood Plains, and Eolian Deposits

The Pleistocene terraces, Holocene flood plains, and most of the eolian deposits are located within the Navaca-Branyon-Navidad and Milby-Kuy-Dutek general soil map units. Some eolian deposits also are within the Dubina-Hallettsville-Straber general soil map unit.

Both the Lavaca and Navidad Rivers and some of their larger tributaries are flanked by one or more terrace levels above their Holocene flood plains. The Dutek, Milby, and Branyon soils are generally restricted to these terrace surfaces. The Branyon soils occur especially in the upper reaches of the Lavaca River. A number of other soils, including the Catilla, Dubina, Hallettsville, Straber, Tremona, Carbengle, and Inez soils, also are on flat terrace surfaces between the uplands and the Holocene flood plains. These soils, found mainly in the uplands, are probably on straths or surfaces cut into bedrock rather than on fluvial deposits laid down by the streams flowing from higher topographic levels. The characteristic profiles of these soils have developed on their respective bedrocks since the surfaces were cut.

Some of the terraces are of Lissie Formation age and represent the streams, which were partly responsible for the development of the deposition of the Pleistocene coast-wise Lissie Formation terrace. Lower terraces may be related to the younger Pleistocene coast-wise terraces, which is the surface of the Beaumont Formation farther to the south in Jackson County.

The Holocene flood plains or bottom land, graded to present-day sea level, include the Navidad, Navaca, and Pursley soils.

Some of the terraces in the lower reaches of the Lavaca and Navidad Rivers are the sites of Kuy soils, which in many places have an undulating stabilized dune surface. Eolian deposition and erosion on these terraces have probably been recurrent throughout Pleistocene and Holocene time.

Another area of former eolian activity is the small part of the Dubina-Hallettsville-Straber general soil map unit on the north side of the Lavaca River between Moulton and Breslau. Many small, poorly defined mounds less than 3 feet high and less than 100 feet in diameter are in this area. Some are elongated in a north-south direction. The soils on the mounds are mainly Dubina and Hallettsville soils. These microrelief features are probably stabilized, isolated areas of wind deposition around clumps of vegetation, which trapped sand, silt, and clay aggregates blown up from past flood plains. These flood plains are now terraces along the Lavaca River.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. Soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A

claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a

short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic)—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated)—Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The movement of water into the soil is rapid.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other

elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or

roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the plants that are the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon,

hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential climax vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The

degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the

horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Nonsodic	less than 6:1
Slight	6-13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, thickness of the line can be one fragment or more. It generally overlies material that weathered in place, and it is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited in stream valleys by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors that are assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. This contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Hallettsville, Texas)

Month	Temperature						Precipitation			
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more
	°F	°F	°F	°F	°F	Units	In	In	In	
January-----	64.6	41.1	52.9	84	16	189	2.41	0.71	3.78	5
February----	67.7	43.7	55.7	86	20	204	2.62	.98	3.98	5
March-------	75.1	50.9	63.0	91	27	410	1.95	.56	3.07	4
April-------	81.3	59.2	70.3	92	36	609	3.44	1.33	5.20	4
May---------	86.5	64.8	75.7	96	46	797	5.22	1.49	8.23	6
June--------	92.5	70.4	81.5	101	58	945	3.98	1.00	6.36	5
July--------	95.9	72.1	84.0	104	66	1,054	2.41	.53	3.87	4
August------	96.6	71.7	84.2	105	64	1,060	3.12	.85	4.95	5
September---	91.4	67.7	79.6	102	50	888	5.27	1.60	8.25	6
October-----	84.3	58.0	71.2	96	37	657	3.25	.84	5.16	4
November----	73.8	49.2	61.5	89	26	354	2.87	.94	4.47	5
December----	67.2	43.2	55.2	84	20	200	2.44	1.02	3.63	5
Yearly:										
Average---	81.4	57.7	69.6	---	---	---	---	---	---	---
Extreme---	---	---	---	106	15	---	---	---	---	---
Total-----	---	---	---	---	---	7,367	38.98	29.10	48.55	58

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Hallettsville, Texas)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Mar. 1	Mar. 15	Mar. 31
2 years in 10 later than--	Feb. 20	Mar. 6	Mar. 23
5 years in 10 later than--	Feb. 3	Feb. 18	Mar. 7
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 27	Nov. 16	Oct. 31
2 years in 10 earlier than--	Dec. 7	Nov. 24	Nov. 8
5 years in 10 earlier than--	Dec. 27	Dec. 8	Nov. 22

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Hallettsville, Texas)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	294	269	230
8 years in 10	304	277	240
5 years in 10	324	293	260
2 years in 10	350	308	279
1 year in 10	>365	317	290

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BbB	Bleiblerville clay, 1 to 3 percent slopes	8,370	1.3
BrA	Branyon clay, 0 to 1 percent slopes	12,070	1.9
CaB	Carbengle loam, 1 to 3 percent slopes	3,270	0.5
CaC	Carbengle loam, 3 to 5 percent slopes	36,390	5.9
CaC3	Carbengle loam, 2 to 5 percent slopes, eroded	10,490	1.7
CaD	Carbengle loam, 5 to 8 percent slopes	8,680	1.4
CtC	Catilla loamy sand, 1 to 5 percent slopes	10,060	1.6
CuB	Cuero sandy clay loam, 1 to 3 percent slopes	9,780	1.6
DaA	Dacosta sandy clay loam, 0 to 1 percent slopes	4,180	0.7
DeB	Denhawken-Elmendorf complex, 1 to 3 percent slopes	52,746	8.5
DhA	Dietrich fine sandy loam, 0 to 1 percent slopes	190	*
DnB	Dubina loamy fine sand, 1 to 3 percent slopes	37,320	6.0
DuC	Dutek loamy fine sand, 1 to 5 percent slopes	8,250	1.3
EdA	Edna fine sandy loam, 0 to 1 percent slopes	970	0.2
FbB	Falba loamy fine sand, 1 to 3 percent slopes	760	0.1
FnB	Flatonia clay loam, 1 to 3 percent slopes	1,100	0.2
FrB	Fordtran loamy fine sand, 0 to 3 percent slopes	2,260	0.4
FsB	Frelsburg clay, 1 to 3 percent slopes	28,010	4.5
FsC	Frelsburg clay, 3 to 5 percent slopes	25,320	4.1
FsD	Frelsburg clay, 5 to 8 percent slopes	390	0.1
GrB	Greenvine clay loam, 1 to 3 percent slopes	2,070	0.3
GrC	Greenvine clay loam, 3 to 5 percent slopes	960	0.2
GrD4	Greenvine-Gullied land complex, 3 to 8 percent slopes	760	0.1
HaB	Hallettsville fine sandy loam, 1 to 3 percent slopes	34,730	5.6
InB	Inez loamy fine sand, 0 to 2 percent slopes	35,520	5.7
KuC	Kuy loamy fine sand, 1 to 5 percent slopes	9,470	1.5
LaA	Lake Charles clay, 0 to 1 percent slopes	1,010	0.2
LtC3	Latium clay, 3 to 5 percent slopes, eroded	6,520	1.0
LtD4	Latium clay, 5 to 8 percent slopes, severely eroded	2,940	0.5
MbB	Milby loamy sand, 0 to 3 percent slopes	9,500	1.5
McA	Morales-Cieno complex, 0 to 1 percent slopes	45,640	7.3
NaA	Nada-Cieno complex, 0 to 1 percent slopes	400	0.1
Nc	Navaca clay, frequently flooded	21,540	3.5
NvB	Navidad fine sandy loam, occasionally flooded, 1 to 3 percent slopes	4,860	0.8
Pe	Pulexas fine sandy loam, frequently flooded	2,410	0.4
Pu	Pursley loam, frequently flooded	6,390	1.0
StC	Straber loamy sand, 1 to 5 percent slopes	83,470	13.4
StD4	Straber-Gullied land complex, 2 to 8 percent slopes	5,960	1.0
TeA	Telferner fine sandy loam, 0 to 1 percent slopes	3,360	0.5
TrC	Tremona loamy fine sand, 1 to 5 percent slopes	83,420	13.4
	Total	621,536	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
BbB	Bleiblerville clay, 1 to 3 percent slopes
BrA	Branyon clay, 0 to 1 percent slopes
CuB	Cuero sandy clay loam, 1 to 3 percent slopes
DeB	Denhawken-Elmendorf complex, 1 to 3 percent slopes
DnB	Dubina loamy fine sand, 1 to 3 percent slopes
FnB	Flatonia clay loam, 1 to 3 percent slopes
FsB	Frelsburg clay, 1 to 3 percent slopes
FsC	Frelsburg clay, 3 to 5 percent slopes
GrB	Greenvine clay loam, 1 to 3 percent slopes
GrC	Greenvine clay loam, 3 to 5 percent slopes
HaB	Hallettsville fine sandy loam, 1 to 3 percent slopes
LaA	Lake Charles clay, 0 to 1 percent slopes
NvB	Navidad fine sandy loam, occasionally flooded, 1 to 3 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Grain sorghum	Corn	Wheat	Rice*	Improved bermudagrass
		Bu	Bu	Bu	Bu	AUM**
BbB------------- Bleiblerville	IIe	80	75	35	---	8.5
BrA------------- Branyon	IIw	90	85	35	---	9.5
CaB------------- Carbengle	IIe	55	50	30	---	7.0
CaC------------- Carbengle	IIIe	50	40	25	---	6.0
CaC3------------ Carbengle	IVe	---	30	---	---	4.0
CaD------------- Carbengle	IVe	---	---	---	---	5.0
CtC------------- Catilla	IIIe	---	---	---	---	4.5
CuB------------- Cuero	IIe	60	55	30	---	7.0
DaA------------- Dacosta	IIIw	80	75	---	100	10.0
DeB------------- Denhawken-Elmendorf	IIIe	70	65	35	---	7.5
DhA------------- Dietrich	IVs	---	---	---	---	3.0
DnB------------- Dubina	IIIe	60	55	---	---	7.5
DuC------------- Dutek	IIIe	30	---	---	---	5.0
EdA------------- Edna	IIIw	55	40	---	120	8.0
FbB------------- Falba	IVe	35	25	---	---	5.0
FnB------------- Flatonia	IIe	60	60	---	---	7.0
FrB------------- Fordtran	IIIw	45	---	---	---	5.5
FsB------------- Frelsburg	IIe	80	75	35	---	8.5
FsC------------- Frelsburg	IIIe	70	60	30	---	7.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Grain sorghum	Corn	Wheat	Rice*	Improved bermudagrass
		Bu	Bu	Bu	Bu	AUM**
FsD------------- Frelsburg	IVe	30	30	20	---	5.0
GrB------------- Greenvine	IIe	80	50	---	---	7.5
GrC------------- Greenvine	IIIe	55	40	---	---	7.0
GrD4***--------- Greenvine-Gullied land	VIe	---	---	---	---	---
HaB------------- Hallettsville	IIe	70	70	---	---	7.0
InB------------- Inez	IIIw	60	50	---	85	7.0
KuC------------- Kuy	IIIs	---	---	---	---	6.0
LaA------------- Lake Charles	IIw	90	75	---	130	10.0
LtC3------------ Latium	IVe	---	---	---	---	5.0
LtD4------------ Latium	VIe	---	---	---	---	4.0
MbB------------- Milby	IIIs	---	---	---	---	6.0
McA------------- Morales-Cieno	IIIw	---	---	---	90	7.0
NaA------------- Nada-Cieno	IIIw	---	---	---	110	6.0
Nc-------------- Navaca	Vw	---	---	---	---	8.0
NvB------------- Navidad	IIw	---	75	---	---	7.0
Pe-------------- Pulexas	Vw	---	---	---	---	6.5
Pu-------------- Pursley	Vw	---	---	---	---	8.0
StC------------- Straber	IIIe	40	---	---	---	6.0
StD4**---------- Straber-Gullied land	VIe	---	---	---	---	---
TeA------------- Telferner	IIIw	45	---	---	80	8.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Grain sorghum	Corn	Wheat	Rice*	Improved bermudagrass
		Bu	Bu	Bu	Bu	AUM**
TrC-------------- Tremona	IIIe	45	---	---	---	5.5

* Rice yields are for irrigated cropland.

** Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

*** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND PRODUCTIVITY

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
BbB----------------------- Bleiblerville	Blackland (Blackland Prairie)----------	7,500	6,000	4,500
BrA----------------------- Branyon	Blackland (Blackland Prairie)----------	7,500	6,000	4,500
CaB, CaC, CaC3, CaD------ Carbengle	Clay Loam------------------------------	5,500	4,000	2,500
CtC----------------------- Catilla	Deep Sand Savannah---------------------	4,500	3,500	2,000
CuB----------------------- Cuero	Clay Loam------------------------------	6,500	5,000	3,000
DaA----------------------- Dacosta	Blackland (Coast Prairie)--------------	7,000	5,500	4,000
DeB*:				
Denhawken----------------	Rolling Blackland----------------------	6,000	5,000	4,000
Elmendorf----------------	Rolling Blackland----------------------	6,000	5,000	4,000
DhA----------------------- Dietrich	Salty Prairie--------------------------	5,000	4,000	3,000
DnB----------------------- Dubina	Sandy Loam-----------------------------	6,000	4,500	3,000
DuC----------------------- Dutek	Sandy----------------------------------	4,500	4,000	2,000
EdA----------------------- Edna	Claypan Prairie------------------------	8,000	6,000	5,000
FbB----------------------- Falba	Claypan Savannah-----------------------	5,500	4,000	2,500
FnB----------------------- Flatonia	Clay Loam------------------------------	6,000	4,500	3,000
FrB----------------------- Fordtran	Sandy Prairie--------------------------	6,000	4,500	3,000
FsB, FsC, FsD------------ Frelsburg	Blackland (Blackland Prairie)----------	7,500	6,000	4,500
GrB, GrC----------------- Greenvine	Blackland (Blackland Prairie)----------	7,000	5,000	3,000
GrD4*:				
Greenvine----------------	Eroded Blackland-----------------------	5,500	4,000	3,000
Gullied land.				
HaB----------------------- Hallettsville	Claypan Savannah-----------------------	6,500	5,000	3,000

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
InB: Inez	Sandy Loam	6,500	5,000	4,000
KuC: Kuy	Deep Sand	4,500	3,250	2,000
LaA: Lake Charles	Blackland (Coast Prairie)	8,000	6,000	5,000
LtC3, LtD4: Latium	Eroded Blackland	6,000	5,000	3,000
MbB: Milby	Sandy	5,000	3,500	2,500
McA*:				
Morales	Sandy Loam	6,500	5,000	4,000
Cieno	Lowland	7,000	6,000	5,000
NaA*:				
Nada	Claypan Prairie	5,000	4,000	2,000
Cieno	Lowland	8,000	6,000	5,000
Nc: Navaca	Clayey Bottomland	8,000	6,500	5,000
NvB: Navidad	Loamy Bottomland	8,000	6,500	5,000
Pe: Pulexas	Loamy Bottomland	6,500	5,000	3,500
Pu: Pursley	Loamy Bottomland	7,500	5,500	4,000
StC: Straber	Sandy Loam	6,000	4,500	3,000
StD4*:				
Straber	Sandy Loam	5,000	3,500	2,500
Gullied land.				
TeA: Telferner	Loamy Prairie	6,500	5,000	3,500
TrC: Tremona	Sandy	5,000	4,000	2,500

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BbB: Bleiblerville	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
BrA: Branyon	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
CaB, CaC, CaC3: Carbengle	Slight	Slight	Moderate: slope, depth to rock, small stones.	Slight	Moderate: depth to rock.
CaD: Carbengle	Slight	Slight	Severe: slope.	Slight	Moderate: depth to rock.
CtC: Catilla	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
CuB: Cuero	Slight	Slight	Moderate: slope.	Slight	Slight.
DaA: Dacosta	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
DeB*:					
Denhawken	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
Elmendorf	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
DhA: Dietrich	Severe: wetness, excess sodium.	Severe: wetness, excess sodium.	Severe: wetness, excess sodium.	Severe: wetness.	Severe: excess sodium, wetness.
DnB: Dubina	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
DuC: Dutek	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: droughty, too sandy.
EdA: Edna	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
FbB: Falba	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FnB: Flatonia	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
FrB: Fordtran	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: too sandy, wetness.	Moderate: wetness, droughty.
FsB: Frelsburg	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
FsC: Frelsburg	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey.	Severe: too clayey.
FsD: Frelsburg	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
GrB, GrC: Greenvine	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, too clayey, percs slowly.	Slight	Severe: too clayey.
GrD4*:					
Greenvine	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
Gullied land	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
HaB: Hallettsville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
InB: Inez	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
KuC: Kuy	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty, too sandy.
LaA: Lake Charles	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
LtC3: Latium	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly, slope.	Moderate: too clayey.	Severe: too clayey.
LtD4: Latium	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MbB-------------------- Milby	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: too sandy.	Severe: droughty.
McA*:					
Morales--------------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Cieno----------------	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
NaA*:					
Nada-----------------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Cieno----------------	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
Nc-------------------- Navaca	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, flooding, percs slowly.	Severe: too clayey.	Severe: flooding, too clayey.
NvB------------------- Navidad	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: droughty, flooding.
Pe-------------------- Pulexas	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Pu-------------------- Pursley	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
StC------------------- Straber	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
StD4*:					
Straber--------------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
Gullied land---------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
TeA------------------- Telferner	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
TrC------------------- Tremona	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor")

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
BbB----------------- Bleiblerville	Good	Good	Fair	Fair	Poor	Poor	Good	Poor	Fair.
BrA----------------- Branyon	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
CaB, CaC, CaC3, CaD---------------- Carbengle	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
CtC----------------- Catilla	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
CuB----------------- Cuero	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Fair.
DaA----------------- Dacosta	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
DeB*:									
Denhawken---------	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Elmendorf---------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
DhA----------------- Dietrich	Fair	Fair	Fair	Good	Poor	Fair	Fair	Fair	Fair.
DnB----------------- Dubina	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
DuC----------------- Dutek	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
EdA----------------- Edna	Fair	Fair	Fair	Fair	Good	Good	Fair	Good	Fair.
FbB----------------- Falba	Fair	Good	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
FnB----------------- Flatonia	Good	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair.
FrB----------------- Fordtran	Poor	Fair	Good	Good	Fair	Fair	Fair	Fair	Good.
FsB----------------- Frelsburg	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
FsC, FsD----------- Frelsburg	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
GrB----------------- Greenvine	Good	Good	Fair	Fair	Poor	Poor	Good	Poor	Fair.
GrC----------------- Greenvine	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
GrD4*:									
Greenvine	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Gullied land	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
HaB Hallettsville	Fair	Good	Fair	Good	Poor	Poor	Fair	Poor	Good.
InB Inez	Fair	Good	Good	Fair	Fair	Fair	Good	Fair	Fair.
KuC Kuy	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
LaA Lake Charles	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair.
LtC3 Latium	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
LtD4 Latium	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
MbB Milby	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
McA*:									
Morales	Fair	Good	Good	Fair	Fair	Fair	Good	Fair	Fair.
Cieno	Poor	Fair	Fair	Fair	Good	Good	Fair	Good	Fair.
NaA*:									
Nada	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Cieno	Poor	Fair	Fair	Fair	Good	Good	Fair	Good	Fair.
Nc Navaca	Poor	Fair	Fair	Fair	Poor	Poor	Fair	Very poor	Fair.
NvB Navidad	Poor	Fair	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.
Pe Pulexas	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
Pu Pursley	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
StC Straber	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
StD4*:									
Straber	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Gullied land	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
TeA Telferner	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
TrC Tremona	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BbB--------------- Bleiblerville	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
BrA--------------- Branyon	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
CaB--------------- Carbengle	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Moderate: low strength.	Moderate: depth to rock.
CaC, CaC3, CaD---- Carbengle	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.	Moderate: depth to rock.
CtC--------------- Catilla	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
CuB--------------- Cuero	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
DaA--------------- Dacosta	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
DeB*:						
Denhawken--------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Elmendorf--------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
DhA--------------- Dietrich	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: excess sodium, wetness.
DnB--------------- Dubina	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
DuC--------------- Dutek	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
EdA--------------- Edna	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
FbB--------------- Falba	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FnB--------------- Flatonia	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
FrB--------------- Fordtran	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
FsB, FsC, FsD----- Frelsburg	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
GrB, GrC---------- Greenvine	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
GrD4*:						
Greenvine---------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Gullied land------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HaB--------------- Hallettsville	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
InB--------------- Inez	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
KuC--------------- Kuy	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Slight----------	Moderate: droughty, too sandy.
LaA--------------- Lake Charles	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness, too clayey.
LtC3, LtD4-------- Latium	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
MbB--------------- Milby	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
McA*:						
Morales-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
Cieno-------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
NaA*:						
Nada	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
Cieno	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
Nc: Navaca	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: flooding, too clayey.
NvB: Navidad	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Pe: Pulexas	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Pu: Pursley	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
StC: Straber	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
StD4*:						
Straber	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Gullied land	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
TeA: Telferner	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
TrC: Tremona	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BbB----------------- Bleiblerville	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
BrA----------------- Branyon	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
CaB, CaC, CaC3, CaD- Carbengle	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
CtC----------------- Catilla	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Poor: seepage.
CuB----------------- Cuero	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
DaA----------------- Dacosta	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
DeB*:					
Denhawken----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
Elmendorf----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
DhA----------------- Dietrich	Severe: wetness, percs slowly.	Slight-----------	Severe: excess sodium, wetness.	Severe: wetness.	Poor: hard to pack, wetness, excess sodium.
DnB----------------- Dubina	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
DuC----------------- Dutek	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
EdA----------------- Edna	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
FbB----------------- Falba	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock.	Severe: depth to rock, wetness, too clayey.	Severe: depth to rock, wetness.	Poor: depth to rock, too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FnB------------------ Flatonia	Severe: percs slowly.	Moderate: depth to rock, slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, hard to pack.
FrB------------------ Fordtran	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
FsB------------------ Frelsburg	Severe: percs slowly.	Slight-----------	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
FsC, FsD------------ Frelsburg	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
GrB, GrC------------ Greenvine	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: too clayey, depth to rock, hard to pack.
GrD4*:					
Greenvine----------	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: too clayey, depth to rock, hard to pack.
Gullied land-------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
HaB------------------ Hallettsville	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
InB------------------ Inez	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
KuC------------------ Kuy	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: seepage.
LaA------------------ Lake Charles	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
LtC3, LtD4---------- Latium	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
MbB------------------ Milby	Severe: wetness, poor filter.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
McA*:					
Morales	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
Cieno	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
NaA*:					
Nada	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
Cieno	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Nc Navaca	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: too clayey, hard to pack.
NvB Navidad	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding, seepage.	Poor: too sandy.
Pe Pulexas	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
Pu Pursley	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
StC Straber	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
StD4*:					
Straber	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Gullied land	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
TeA Telferner	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
TrC Tremona	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BbB------------------- Bleiblerville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BrA------------------- Branyon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CaB, CaC, CaC3, CaD--- Carbengle	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, excess lime.
CtC------------------- Catilla	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
CuB------------------- Cuero	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
DaA------------------- Dacosta	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
DeB*:				
Denhawken------------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Elmendorf------------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
DhA------------------- Dietrich	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
DnB------------------- Dubina	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
DuC------------------- Dutek	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
EdA------------------- Edna	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
FbB------------------- Falba	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FnB: Flatonia	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
FrB: Fordtran	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, thin layer.
FsB, FsC, FsD: Frelsburg	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GrB, GrC: Greenvine	Poor: low strength, shrink-swell, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GrD4*:				
Greenvine	Poor: low strength, shrink-swell, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Gullied land	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HaB: Hallettsville	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
InB: Inez	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
KuC: Kuy	Good	Probable	Improbable: too sandy.	Fair: too sandy.
LaA: Lake Charles	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
LtC3, LtD4: Latium	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MbB: Milby	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, thin layer.
McA*:				
Morales	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Cieno	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NaA*:				
Nada	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
NaA*:				
Cieno	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Nc Navaca	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
NvB Navidad	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Pe Pulexas	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Pu Pursley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
StC Straber	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
StD4*:				
Straber	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Gullied land	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
TeA Telferner	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
TrC Tremona	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BbB: Bleiblerville	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
BrA: Branyon	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
CaB: Carbengle	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
CaC, CaC3, CaD: Carbengle	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
CtC: Catilla	Severe: seepage.	Severe: piping, seepage.	Deep to water	Slope, droughty, fast intake.	Soil blowing, too sandy.	Droughty.
CuB: Cuero	Severe: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
DaA: Dacosta	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
DeB*:						
Denhawken	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Elmendorf	Slight	Moderate: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
DhA: Dietrich	Slight	Severe: wetness, excess sodium.	Percs slowly, excess sodium.	Wetness, droughty, percs slowly.	Wetness, soil blowing, percs slowly.	Wetness, excess sodium, droughty.
DnB: Dubina	Slight	Moderate: thin layer, piping, hard to pack.	Percs slowly	Wetness, fast intake.	Wetness, soil blowing, percs slowly.	Wetness, percs slowly.
DuC: Dutek	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Too sandy, soil blowing.	Droughty.
EdA: Edna	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
FbB: Falba	Moderate: depth to rock.	Severe: hard to pack, wetness.	Percs slowly, depth to rock.	Wetness, percs slowly, depth to rock.	Depth to rock, erodes easily, wetness.	Wetness, erodes easily, depth to rock.
FnB: Flatonia	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
FrB: Fordtran	Slight	Moderate: wetness, hard to pack.	Percs slowly	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Wetness, droughty, percs slowly.
FsB: Frelsburg	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
FsC, FsD: Frelsburg	Slight	Severe: hard to pack.	Deep to water	Slow intake, slope, percs slowly.	Percs slowly	Percs slowly.
GrB, GrC: Greenvine	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Percs slowly, slow intake, depth to rock.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
GrD4*: Greenvine	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Percs slowly, slow intake, depth to rock.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
Gullied land	Severe: slope.	Slight	Deep to water	Slope	Slope	Slope.
HaB: Hallettsville	Slight	Moderate: hard to pack.	Deep to water	Soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
InB: Inez	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, soil blowing.	Wetness, percs slowly.	Wetness, percs slowly.
KuC: Kuy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Too sandy, soil blowing.	Droughty.
LaA: Lake Charles	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
LtC3, LtD4: Latium	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
MbB: Milby	Severe: seepage.	Moderate: piping, wetness.	Favorable	Wetness, droughty, fast intake.	Wetness, soil blowing.	Droughty.
McA*: Morales	Slight	Severe: wetness.	Percs slowly	Wetness, soil blowing, percs slowly.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, percs slowly.
Cieno	Slight	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
NaA*: Nada	Slight	Severe: wetness.	Percs slowly	Wetness, soil blowing, percs slowly.	Wetness, soil blowing, percs slowly.	Wetness, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
NaA*:						
Cieno	Slight	Severe: ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Nc: Navaca	Severe: seepage.	Moderate: hard to pack, wetness.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Percs slowly.
NvB: Navidad	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, flooding.	Too sandy	Droughty.
Pe: Pulexas	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, flooding.	Soil blowing	Favorable.
Pu: Pursley	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Favorable	Favorable.
StC: Straber	Slight	Moderate: hard to pack.	Deep to water	Slope, percs slowly, fast intake.	Percs slowly, soil blowing.	Percs slowly.
StD4*:						
Straber	Slight	Moderate: hard to pack.	Deep to water	Slope, percs slowly, fast intake.	Percs slowly, soil blowing.	Percs slowly.
Gullied land	Severe: slope.	Slight	Deep to water	Slope	Slope	Slope.
TeA: Telferner	Slight	Severe: wetness.	Percs slowly	Wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, percs slowly.
TrC: Tremona	Slight	Moderate: hard to pack, wetness.	Percs slowly, slope.	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Droughty, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In								Pct	
BbB-------------- Bleiblerville	0-29	Clay--------------	CH	A-7-6	95-100	95-100	90-100	80-100	55-85	35-60
	29-80	Clay, silty clay	CH	A-7-6	95-100	95-100	90-100	80-100	55-85	35-60
BrA-------------- Branyon	0-6	Clay--------------	CH	A-7-6	95-100	85-100	80-100	75-100	54-80	35-55
	6-55	Clay, silty clay	CH	A-7-6	95-100	85-100	80-100	75-100	54-80	35-55
	55-80	Clay, sandy clay, clay loam, sandy clay loam.	CH, CL, GC, SC	A-2, A-4, A-6, A-7	40-100	35-100	30-100	25-100	25-80	8-60
CaB, CaC, CaC3, CaD-------------- Carbengle	0-5	Loam--------------	CL	A-6, A-4	90-100	85-100	70-98	51-80	25-40	8-20
	5-32	Clay loam, sandy clay loam.	CL, SC	A-6, A-4	85-100	85-100	70-98	36-85	25-40	8-20
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---
CtC-------------- Catilla	0-10	Loamy sand--------	SM, SP-SM	A-2-4, A-3	95-100	90-100	80-100	8-30	<25	NP-4
	10-49	Loamy sand--------	SM, SP-SM	A-2-4, A-3	95-100	90-100	80-100	8-28	<25	NP-3
	49-80	Sandy clay loam---	SC, CL	A-6, A-4	95-100	90-100	80-100	36-55	25-40	8-20
CuB-------------- Cuero	0-8	Sandy clay loam---	CL, SC	A-4, A-6, A-2-4, A-2-6	95-100	95-100	70-97	30-70	25-35	8-15
	8-36	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	95-100	95-100	80-100	40-80	30-45	11-22
	36-48	Sandy clay loam, clay loam.	CL, SC	A-6	85-100	85-100	80-90	36-55	30-40	11-20
	48-52	Variable----------	---	---	---	---	---	---	---	---
DaA-------------- Dacosta	0-6	Sandy clay loam---	CL	A-6, A-7	95-100	90-100	90-100	65-80	35-45	18-25
	6-62	Clay, clay loam, sandy clay.	CH, CL	A-7-6	95-100	90-100	90-100	70-95	48-65	30-40
	62-80	Sandy clay loam, sandy clay, clay loam.	CL, CH	A-7-6	95-100	90-100	85-95	65-80	45-60	25-40
DeB*: Denhawken-------	0-6	Clay loam, sandy clay loam.	CL, CH	A-6, A-7	95-100	90-100	90-100	60-90	35-55	16-33
	6-22	Clay loam, clay---	CH, CL	A-7	95-100	90-100	65-100	60-90	40-60	20-38
	22-43	Clay loam, clay---	CH, CL	A-7	95-100	90-100	85-100	70-95	48-68	25-43
	43-80	Clay loam, clay---	CH, CL	A-7	95-100	90-100	85-100	70-95	48-68	25-43
Elmendorf-------	0-25	Sandy clay loam, clay loam.	CL	A-6, A-7	95-100	90-100	90-100	65-90	30-50	15-28
	25-54	Clay loam, sandy clay, clay.	CH, CL	A-7	95-100	90-100	90-100	70-95	45-65	25-40
	54-80	Clay, sandy clay loam, sandy clay.	CH, CL	A-7	95-100	90-100	90-100	70-95	45-60	25-36
DhA-------------- Dietrich	0-12	Fine sandy loam---	SM-SC, CL-ML, SC, CL	A-2-4, A-2-6, A-4, A-6	100	95-100	90-100	30-60	16-30	6-19
	12-52	Clay loam, sandy clay loam.	SC, CL, CH	A-7-6	100	100	90-100	39-70	40-53	22-35
	52-80	Sandy clay loam, loam, fine sandy loam, sandy clay.	SC, CL, CH	A-7-6	95-100	90-100	85-100	36-66	40-55	25-40

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In								Pct	
DnB: Dubina	0-11	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4, A-3	95-100	95-100	75-100	8-35	<25	NP-5
	11-33	Sandy clay, clay	CL, CH	A-7-6	95-100	95-100	80-100	35-65	40-65	20-35
	33-61	Clay loam, sandy clay loam.	CL, CH, SC	A-6, A-7, A-4	95-100	95-100	75-100	25-55	25-55	7-28
	61-80	Sandy loam, loamy sand, sandy clay loam.	SC, CL-ML, SM-SC, CL	A-2-4, A-4, A-6, A-7-6	95-100	90-100	75-100	15-55	20-50	5-30
DuC: Dutek	0-28	Loamy fine sand, loamy sand.	SM, SP-SM	A-2, A-3	95-100	95-100	85-100	9-25	<22	NP-3
	28-52	Sandy clay loam, sandy loam, sandy clay, fine sandy loam.	CL, SC, SM-SC, CL-ML	A-2, A-4, A-6	98-100	95-100	90-100	30-55	24-40	6-20
	52-65	Fine sandy loam, sandy loam.	SC, SM-SC, CL-ML, CL	A-2, A-4, A-6	95-100	95-100	90-100	22-55	20-40	4-20
	65-80	Loamy fine sand, loamy sand, very fine sand.	SM, SM-SC, SP-SM	A-2	95-100	95-100	85-100	10-35	<25	NP-7
EdA: Edna	0-8	Fine sandy loam	SM, SM-SC, ML, SC	A-4	100	95-100	80-100	36-66	20-32	3-15
	8-18	Clay, sandy clay	CH	A-7	100	98-100	90-100	60-80	50-72	28-46
	18-62	Clay, sandy clay	CL, CH	A-7	100	98-100	80-100	70-80	41-60	20-36
	62-80	Clay, sandy clay, sandy clay loam.	CL, CH	A-7, A-6	98-100	98-100	80-100	55-80	30-60	13-35
FbB: Falba	0-12	Loamy fine sand	SM, SM-SC	A-2-4, A-4	95-100	95-100	60-95	15-40	<25	NP-7
	12-43	Clay, sandy clay	CH	A-7	98-100	95-100	90-100	75-95	51-70	34-48
	43-49	Sandy clay loam, fine sandy loam.	CL, SC	A-6, A-7	98-100	95-100	80-100	36-70	34-50	21-30
	49-80	Unweathered bedrock.	---	---	---	---	---	---	---	---
FnB: Flatonia	0-6	Clay loam	CL, CH	A-6, A-7-6	80-100	80-100	75-100	50-70	39-56	21-34
	6-42	Clay, sandy clay, clay loam.	CH, CL	A-7-6	95-100	90-100	90-100	50-80	46-64	28-41
	42-48	Clay, clay loam, sandy clay.	CH, CL	A-7-6, A-6	95-100	90-100	80-100	60-90	35-56	15-34
	48-80	Weathered bedrock	---	---	---	---	---	---	---	---
FrB: Fordtran	0-24	Loamy fine sand	SM, SM-SC	A-2-4	95-100	95-100	75-100	13-30	<25	NP-6
	24-46	Sandy clay, clay	CH, CL	A-7	90-100	90-100	80-100	51-90	41-55	20-30
	46-80	Sandy clay loam, clay loam, sandy clay, clay.	CH, CL	A-6, A-7	95-100	95-100	70-100	36-95	30-60	12-35
FsB, FsC, FsD: Frelsburg	0-8	Clay	CH	A-7-6	95-100	95-100	90-100	85-100	55-90	35-65
	8-80	Clay	CH	A-7-6	95-100	95-100	90-100	85-100	55-90	35-65
GrB, GrC: Greenvine	0-6	Clay loam	CH, CL	A-7-6	100	95-100	90-100	70-85	48-62	27-35
	6-13	Clay, silty clay	CH	A-7-6	100	95-100	90-100	75-98	55-90	32-55
	13-48	Clay, silty clay	CH	A-7-6	100	100	90-100	75-98	55-90	32-55
	48-67	Weathered bedrock	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In								Pct	
GrD4*:										
Greenvine-------	0-5	Clay-------------	CH	A-7-6	100	95-100	90-100	75-98	55-75	32-50
	5-31	Clay, silty clay	CH	A-7-6	100	95-100	90-100	75-98	55-90	32-55
	31-80	Weathered bedrock	---	---	---	---	---	---	---	---
Gullied land----	0-40	Variable---------	---	---	---	---	---	---	---	---
HaB-------------- Hallettsville	0-8	Fine sandy loam	CL, SC	A-6, A-4	95-100	90-100	75-100	40-70	25-40	8-21
	8-35	Sandy clay, clay	CH, CL	A-7	95-100	90-100	80-100	55-85	42-60	25-40
	35-54	Sandy clay loam, clay, sandy clay.	CL, CH	A-6, A-7	95-100	90-100	75-100	50-80	30-55	13-33
	54-80	Fine sandy loam, sandy clay loam.	SC, CL	A-2-4, A-2-6, A-4, A-6	95-100	90-100	75-100	25-55	25-38	8-18
InB-------------- Inez	0-14	Loamy fine sand	SM, SM-SC	A-2-4, A-4	98-100	98-100	90-100	22-45	<25	NP-7
	14-53	Clay, sandy clay	CL, CH	A-7-6	98-100	98-100	90-100	50-75	41-66	25-45
	53-80	Sandy clay, clay loam, sandy clay loam.	CL, CH, SC	A-6, A-7-6	98-100	98-100	90-100	49-75	36-55	25-40
KuC-------------- Kuy	0-52	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4, A-3	100	95-100	70-100	6-35	<25	NP-7
	52-80	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	95-100	90-100	75-100	36-70	21-40	7-21
LaA-------------- Lake Charles	0-30	Clay-------------	CH	A-7	100	99-100	80-100	75-100	64-80	40-55
	30-62	Clay-------------	CH	A-7	98-100	98-100	80-100	75-100	54-90	37-60
	62-80	Clay-------------	CH	A-7	94-100	94-100	80-95	75-95	51-90	30-60
LtC3, LtD4------- Latium	0-5	Clay-------------	CH	A-7-6	95-100	90-100	85-100	80-100	55-85	35-60
	5-80	Clay-------------	CH	A-7-6	95-100	90-100	85-100	80-100	55-85	35-60
MbB-------------- Milby	0-7	Loamy sand-------	SM, SM-SC	A-2-4	100	95-100	75-100	15-35	<25	NP-7
	7-29	Loamy sand-------	SM, SM-SC	A-2-4	100	95-100	75-100	15-35	<25	NP-7
	29-66	Sandy clay loam, sandy clay.	SC, CL	A-6, A-7, A-2-7, A-2-6	100	95-100	75-100	22-52	26-45	10-25
	66-80	Sandy clay, clay, sandy clay loam.	CL, CH	A-6, A-7	100	95-100	75-100	65-94	35-55	15-30
McA*:										
Morales----------	0-8	Fine sandy loam, sandy loam, loamy fine sand.	SM, SM-SC, ML, CL-ML	A-4	98-100	95-100	75-100	35-65	<25	NP-7
	8-16	Sandy clay loam, loam, clay loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	98-100	95-100	75-100	45-75	21-40	5-20
	16-80	Sandy clay, sandy clay loam, clay loam.	CL	A-6, A-7-6	98-100	95-100	75-100	50-80	35-50	21-35
Cieno------------	0-6	Loam-------------	CL	A-6	98-100	95-100	85-100	51-70	28-40	15-25
	6-64	Sandy clay loam, clay loam, sandy clay.	CL	A-6, A-7-6	98-100	95-100	90-100	60-85	32-42	20-30
	64-80	Sandy clay loam, clay loam.	CL, SC	A-6	98-100	95-100	85-100	40-70	28-40	15-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	4	10	40	200		
	In								Pct	
NaA*:										
Nada------------	0-7	Fine sandy loam, sandy loam.	SM, SM-SC	A-4	95-100	95-100	80-100	36-49	<25	NP-7
	7-26	Sandy clay loam, clay loam, sandy clay.	CL	A-6, A-7-6	98-100	95-100	90-100	51-75	30-44	19-32
	26-80	Sandy clay loam, clay loam.	CL, SC	A-6	95-100	95-100	85-100	40-70	28-40	15-25
Cieno-----------	0-6	Loam-------------	CL	A-6	98-100	95-100	85-100	51-70	28-40	15-25
	6-62	Sandy clay loam, clay loam, sandy clay.	CL	A-6, A-7-6	98-100	95-100	90-100	60-85	32-42	20-30
	62-80	Sandy clay loam, clay loam.	CL, SC	A-6	98-100	95-100	85-100	40-70	28-40	15-25
Nc--------------- Navaca	0-31	Clay, silty clay	CH, CL	A-7	100	100	90-100	75-98	47-65	25-40
	31-45	Fine sandy loam, loam.	SC, SM-SC,	A-4, A-6,	100	100	75-100	12-50	20-35	NP-15
	45-80	Loamy fine sand, fine sand.	SM-SC, SM, SP-SM	A-2-4	100	100	69-100	10-30	<28	NP-7
NvB-------------- Navidad	0-6	Fine sandy loam	SC, SM-SC	A-4, A-6, A-2-4, A-2-6	100	100	95-100	15-45	21-30	4-11
	6-80	Fine sandy loam, sandy clay loam, loamy fine sand, fine sand, sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	100	90-100	75-100	15-51	21-40	4-20
Pe--------------- Pulexas	0-46	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	100	95-100	70-85	36-55	<30	NP-7
	46-80	Fine sandy loam, very fine sandy loam, loam, fine sand.	SM, SC, ML, CL	A-4	100	95-100	90-100	45-74	<30	NP-10
Pu--------------- Pursley	0-16	Loam, clay loam	CL	A-4, A-6, A-7-6	100	95-100	85-100	55-85	25-43	8-25
	16-80	Loam, clay loam	CL	A-4, A-6, A-7-6	100	95-100	85-100	55-85	25-43	8-25
StC-------------- Straber	0-14	Loamy sand-------	SM, SM-SC	A-2	95-100	90-100	50-85	15-35	<25	NP-6
	14-23	Clay, sandy clay	CL, CH, SC	A-7	95-100	90-100	70-100	45-65	45-60	25-40
	23-52	Clay, sandy clay	CL, CH, SC	A-7	95-100	90-100	70-100	45-85	45-60	25-40
	52-80	Sandy clay loam, sandy clay.	CL, CH, SC	A-6, A-7, A-2	90-100	85-100	75-100	29-70	35-55	15-35
StD4*:										
Straber---------	0-3	Loamy sand-------	SM, SM-SC	A-2	95-100	90-100	50-85	15-35	<25	NP-6
	3-51	Clay, sandy clay	CL, CH, SC	A-7	95-100	90-100	70-100	45-65	45-60	25-40
	51-80	Clay loam, sandy clay loam, sandy clay.	CL, CH, SC	A-6, A-7, A-2	90-100	85-100	75-100	29-70	35-55	15-35
Gullied land----	0-40	Variable---------	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In								Pct	
TeA-------------- Telferner	0-14	Fine sandy loam	CL, SC, CL-ML, SM-SC	A-4	90-100	90-100	80-100	40-60	20-30	5-10
	14-46	Sandy clay, clay, clay loam.	CH	A-7-6	90-100	90-100	90-100	55-85	51-65	30-40
	46-80	Sandy clay loam, clay loam, sandy clay.	CL	A-6, A-7	90-100	90-100	85-100	50-75	30-45	15-25
TrC-------------- Tremona	0-27	Loamy fine sand	SM, SP-SM	A-2-4, A-3	80-100	80-100	60-100	8-35	<25	NP-3
	27-61	Sandy clay, clay	SC, CL, CH	A-7	80-100	80-100	75-100	36-85	40-60	20-40
	61-80	Sandy clay loam, sandy clay, clay, clay loam.	SC, CL, CH	A-7, A-6, A-2-7, A-2-6	80-100	80-100	70-100	30-85	30-60	15-40

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
BbB	0-29	55-70	1.30-1.50	<0.06	0.15-0.18	7.4-8.4	<2	Very high	0.32	5	4	1-4
Bleiblerville	29-80	55-70	1.30-1.50	<0.06	0.15-0.18	7.4-8.4	<8	Very high	0.32			
BrA	0-6	45-60	1.15-1.45	<0.06	0.15-0.18	6.6-8.4	<2	Very high	0.32	5	4	2-4
Branyon	6-55	40-60	1.20-1.45	<0.06	0.15-0.18	7.4-8.4	<2	Very high	0.32			
	55-80	30-60	1.40-1.55	<2.0	0.11-0.18	7.9-8.4	<4	Very high	0.32			
CaB, CaC, CaC3,												
CaD	0-5	25-34	1.40-1.55	0.6-2.0	0.15-0.20	7.9-8.4	<2	Low	0.32	3	4L	1-3
Carbengle	5-32	25-34	1.40-1.55	0.6-2.0	0.15-0.20	7.9-8.4	<2	Low	0.32			
	32-60	---	---	---	---	---	---	---	---			
CtC	0-10	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-6.5	<2	Very low	0.17	5	2	<1
Catilla	10-49	3-12	1.45-1.65	6.0-20	0.05-0.08	5.6-6.5	<2	Very low	0.17			
	49-80	25-32	1.35-1.65	0.2-0.6	0.12-0.16	4.5-6.5	<2	Low	0.24			
CuB	0-8	20-30	1.40-1.65	0.6-2.0	0.11-0.19	6.1-7.8	<2	Low	0.24	4	5	1-3
Cuero	8-36	25-35	1.45-1.70	0.6-2.0	0.15-0.22	6.6-8.4	<2	Moderate	0.28			
	36-48	25-35	1.45-1.70	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.32			
	48-52	---	---	---	---	---	---	---	---			
DaA	0-6	20-35	1.45-1.70	0.2-0.6	0.15-0.20	6.1-7.3	<4	Moderate	0.32	5	5	1-3
Dacosta	6-62	27-45	1.40-1.60	<0.06	0.15-0.18	6.1-8.4	<4	High	0.32			
	62-80	27-40	1.40-1.65	<0.06	0.13-0.15	6.6-8.4	<8	High	0.32			
DeB*:												
Denhawken	0-6	30-40	1.20-1.50	0.2-0.6	0.13-0.18	7.9-8.4	<2	Moderate	0.32	5	6	1-3
	6-22	35-50	1.25-1.50	<0.06	0.14-0.18	7.9-8.4	<2	High	0.32			
	22-43	35-55	1.35-1.60	<0.06	0.14-0.18	7.9-8.4	<4	High	0.32			
	43-80	35-50	1.35-1.60	<0.06	0.04-0.15	7.9-8.4	2-16	High	0.32			
Elmendorf	0-25	20-34	1.35-1.55	0.2-0.6	0.15-0.20	6.1-8.4	<2	Moderate	0.32	5	6	1-3
	25-54	35-50	1.30-1.60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32			
	54-80	30-45	1.30-1.60	<0.06	0.04-0.18	7.4-8.4	2-16	High	0.32			
DhA	0-12	8-20	1.45-1.70	2.0-6.0	0.09-0.15	6.1-7.3	<2	Low	0.20	5	3	<1
Dietrich	12-52	25-35	1.55-1.70	0.06-0.2	0.08-0.15	7.4-8.4	<8	Moderate	0.32			
	52-80	20-35	1.50-1.70	0.2-0.6	0.05-0.15	7.9-8.4	2-8	Moderate	0.32			
DnB	0-11	5-12	1.55-1.69	2.0-6.0	0.07-0.11	5.6-7.3	<2	Very low	0.24	5	2	1-3
Dubina	11-33	35-45	1.35-1.60	0.06-0.2	0.12-0.17	5.6-7.8	<2	High	0.32			
	33-61	20-40	1.40-1.69	0.06-0.2	0.11-0.16	5.6-8.4	<2	Moderate	0.32			
	61-80	10-35	1.50-1.70	0.2-2.0	0.08-0.14	6.1-8.4	<2	Moderate	0.37			
DuC	0-28	3-12	1.30-1.60	6.0-20	0.05-0.10	5.6-7.3	<2	Very low	0.20	5	2	<1
Dutek	28-52	18-35	1.30-1.65	0.6-2.0	0.12-0.17	4.5-6.0	<2	Low	0.24			
	52-65	10-20	1.30-1.65	0.6-6.0	0.10-0.16	4.5-6.5	<2	Low	0.24			
	65-80	5-12	1.30-1.60	2.0-20	0.05-0.10	4.5-6.5	<2	Very low	0.20			
EdA	0-8	4-15	1.40-1.60	0.6-2.0	0.10-0.15	5.6-7.3	<2	Low	0.37	5	3	5-3
Edna	8-18	35-55	1.35-1.55	<0.06	0.15-0.20	5.6-7.3	<2	High	0.32			
	18-62	35-55	1.35-1.55	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32			
	62-80	30-55	1.30-1.60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
FbB-------------- Falba	0-12	5-12	1.35-1.55	2.0-6.0	0.08-0.11	5.6-7.3	<2	Low--------	0.24	3	2	<1
	12-43	40-50	1.50-1.70	<0.06	0.14-0.18	4.5-6.5	<2	High-------	0.28			
	43-49	18-35	1.45-1.65	<0.06	0.14-0.18	6.1-8.4	<2	High-------	0.28			
	49-80	---	---	---	---	---	---	-----------	----			
FnB-------------- Flatonia	0-6	27-35	1.40-1.65	0.2-0.6	0.12-0.19	6.6-8.4	<2	Moderate	0.32	4	6	1-4
	6-42	35-50	1.50-1.70	0.06-0.2	0.12-0.20	6.6-8.4	<2	High-------	0.32			
	42-48	27-45	1.40-1.70	0.06-0.2	0.12-0.19	7.4-8.4	<2	Moderate	0.37			
	48-80	---	---	---	---	---	---	-----------	----			
FrB-------------- Fordtran	0-24	5-12	1.50-1.70	2.0-6.0	0.07-0.11	5.6-6.5	<2	Low--------	0.24	5	2	<1
	24-46	35-50	1.50-1.70	<0.06	0.15-0.18	5.1-7.8	<2	Moderate	0.32			
	46-80	20-42	1.45-1.65	0.2-0.6	0.15-0.20	6.1-8.4	<2	Moderate	0.32			
FsB, FsC, FsD---- Frelsburg	0-8	45-60	1.25-1.45	<0.06	0.15-0.20	7.9-8.4	<2	Very high	0.32	5	4	1-4
	8-80	45-60	1.30-1.50	<0.06	0.14-0.19	7.9-8.4	<4	Very high	0.32			
GrB, GrC--------- Greenvine	0-6	35-40	1.10-1.30	<0.06	0.12-0.18	6.6-8.4	<2	Very high	0.32	4	4	1-4
	6-13	40-60	1.20-1.40	<0.06	0.12-0.18	6.6-8.4	<2	Very high	0.32			
	13-48	40-60	1.20-1.40	<0.06	0.12-0.18	7.4-8.4	<4	Very high	0.32			
	48-67	---	---	---	---	---	---	-----------	----			
GrD4*:												
Greenvine-------	0-5	40-60	1.10-1.30	<0.06	0.12-0.18	6.6-8.4	<2	Very high	0.32	3	4	1-4
	5-31	40-60	1.20-1.40	<0.06	0.12-0.18	6.6-8.4	<2	Very high	0.32			
	31-80	---	---	---	---	---	---	-----------	----			
Gullied land----	0-40	---	---	---	---	---	---	-----------	----	---	---	---
HaB-------------- Hallettsville	0-8	12-25	1.40-1.60	0.2-0.6	0.12-0.17	5.6-7.3	<2	Moderate	0.37	5	3	1-3
	8-35	35-50	1.30-1.60	<0.06	0.12-0.18	5.6-7.3	<2	High-------	0.32			
	35-54	20-45	1.50-1.69	0.06-0.2	0.08-0.14	7.4-8.4	<4	Moderate	0.32			
	54-80	10-35	1.50-1.69	0.06-0.2	0.08-0.14	6.6-8.4	<4	Moderate	0.32			
InB-------------- Inez	0-14	6-12	1.45-1.70	0.06-2.0	0.09-0.12	6.1-7.3	<2	Low--------	0.32	5	2	<2
	14-53	40-55	1.40-1.60	<0.06	0.14-0.19	4.5-7.3	<2	High-------	0.32			
	53-80	25-40	1.30-1.50	0.06-0.2	0.14-0.19	6.6-8.4	<2	Moderate	0.32			
KuC-------------- Kuy	0-52	5-12	1.50-1.70	6.0-20	0.07-0.11	5.6-7.3	<2	Very low	0.17	5	2	<1
	52-80	20-35	1.45-1.65	0.6-2.0	0.12-0.17	4.5-6.5	<2	Low--------	0.24			
LaA-------------- Lake Charles	0-30	40-60	1.20-1.45	0.06-0.2	0.15-0.20	5.6-7.8	<2	Very high	0.32	5	4	2-6
	30-62	40-60	1.20-1.45	<0.06	0.15-0.20	7.4-8.4	<2	Very high	0.32			
	62-80	40-60	1.30-1.50	<0.06	0.15-0.20	7.9-8.4	<2	Very high	0.32			
LtC3, LtD4------- Latium	0-5	45-60	1.25-1.45	<0.06	0.15-0.18	7.9-8.4	<2	Very high	0.32	4	4	.5-2
	5-80	45-60	1.25-1.45	<0.06	0.15-0.18	7.9-8.4	<2	Very high	0.32			
MbB-------------- Milby	0-7	2-10	1.50-1.70	6.0-20	0.03-0.10	5.6-7.3	<2	Low--------	0.17	5	2	<2
	7-29	2-10	1.50-1.70	6.0-20	0.03-0.10	5.6-7.3	<2	Low--------	0.17			
	29-66	20-40	1.40-1.69	0.6-2.0	0.10-0.15	4.5-6.5	<2	Moderate	0.32			
	66-80	30-45	1.40-1.65	0.6-2.0	0.12-0.17	5.1-7.8	<4	Moderate	0.32			
McA*:												
Morales---------	0-8	5-15	1.45-1.55	0.6-2.0	0.11-0.15	5.1-7.3	<2	Low--------	0.37	5	3	<1
	8-16	20-30	1.45-1.60	0.6-2.0	0.12-0.17	5.6-7.3	<2	Low--------	0.28			
	16-80	25-40	1.40-1.60	<0.06	0.12-0.18	5.1-8.4	<2	Moderate	0.32			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
McA*:												
Cieno-----------	0-6	20-27	1.40-1.60	0.2-0.6	0.12-0.18	5.6-7.3	<2	Moderate	0.32	5	5	1-3
	6-64	24-35	1.40-1.65	<0.06	0.12-0.18	5.6-8.4	<2	Moderate	0.32			
	64-80	20-30	1.40-1.65	0.06-0.2	0.12-0.18	6.6-8.4	<2	Moderate	0.32			
NaA*:												
Nada------------	0-7	2-15	1.50-1.70	0.6-2.0	0.10-0.15	5.6-7.3	<2	Low--------	0.32	5	3	<1
	7-26	20-38	1.50-1.70	<0.06	0.12-0.18	5.6-7.3	<4	Moderate	0.32			
	26-80	20-30	1.45-1.70	0.06-0.2	0.12-0.17	6.6-8.4	<8	Moderate	0.32			
Cieno-----------	0-6	20-27	1.40-1.60	0.2-0.6	0.12-0.18	5.6-7.3	<2	Moderate	0.32	5	5	1-3
	6-62	24-35	1.40-1.65	<0.06	0.12-0.18	5.6-8.4	<2	Moderate	0.32			
	62-80	20-30	1.40-1.65	0.06-0.2	0.12-0.18	6.6-8.4	<2	Moderate	0.32			
Nc--------------- Navaca	0-31	38-60	1.35-1.55	<0.06	0.15-0.20	7.4-8.4	<2	High-------	0.32	5	4	1-4
	31-45	10-26	1.50-1.69	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low--------	0.28			
	45-80	5-12	1.55-1.75	2.0-6.0	0.04-0.10	6.6-8.4	<2	Low--------	0.17			
NvB-------------- Navidad	0-6	10-20	1.35-1.50	0.6-2.0	0.11-0.16	6.6-7.8	<2	Low--------	0.32	5	3	1-3
	6-80	8-22	1.40-1.60	0.6-2.0	0.12-0.17	6.6-7.8	<2	Low--------	0.32			
Pe--------------- Pulexas	0-46	7-18	1.30-1.55	2.0-6.0	0.11-0.15	6.1-8.4	<2	Low--------	0.28	5	3	<2
	46-80	8-18	1.30-1.50	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low--------	0.28			
Pu--------------- Pursley	0-16	18-35	1.20-1.40	0.6-2.0	0.16-0.22	7.4-8.4	<2	Moderate	0.28	5	4L	1-3
	16-80	18-35	1.25-1.45	0.6-2.0	0.15-0.20	7.9-8.4	<2	Moderate	0.28			
StC-------------- Straber	0-14	2-12	1.40-1.60	2.0-6.0	0.07-0.11	5.1-7.3	<2	Very low	0.24	5	2	<1
	14-23	35-53	1.35-1.55	<0.06	0.14-0.18	5.1-5.5	<2	High-------	0.32			
	23-52	35-50	1.50-1.70	0.06-0.2	0.14-0.18	5.1-6.0	<2	Moderate	0.32			
	52-80	25-45	1.55-1.80	0.06-0.2	0.11-0.18	4.5-8.4	<4	Moderate	0.37			
StD4*:												
Straber---------	0-3	2-12	1.40-1.60	2.0-6.0	0.07-0.11	5.1-7.3	<2	Very low	0.24	5	2	<1
	3-51	35-53	1.35-1.55	<0.06	0.14-0.18	5.1-5.5	<2	High-------	0.32			
	51-80	25-45	1.55-1.80	0.06-0.2	0.11-0.18	4.5-8.4	<4	Moderate	0.37			
Gullied land----	0-40	---	---	---	---	---	---	-----------	----	---	---	---
TeA-------------- Telferner	0-14	8-18	1.50-1.70	0.6-2.0	0.10-0.15	6.1-7.3	<2	Low--------	0.43	5	3	<1
	14-46	35-50	1.40-1.60	<0.06	0.14-0.19	6.1-8.4	<2	High-------	0.32			
	46-80	20-40	1.40-1.65	0.06-0.2	0.12-0.15	7.4-8.4	<2	Moderate	0.32			
TrC-------------- Tremona	0-27	2-10	1.50-1.70	6.0-20	0.04-0.10	5.6-6.5	<2	Very low	0.24	5	2	<1
	27-61	35-50	1.40-1.65	<0.06	0.12-0.18	4.5-6.0	<2	High-------	0.28			
	61-80	25-45	1.40-1.65	<0.06	0.12-0.18	4.5-6.0	<2	High-------	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
BbB: Bleiblerville	D	None	---	---	>6.0	---	---	>60	---	High	Low.
BrA: Branyon	D	None	---	---	>6.0	---	---	>60	---	High	Low.
CaB, CaC: Carbengle	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
CaC3: Carbengle	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
CaD: Carbengle	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
CtC: Catilla	B	None	---	---	3.0-5.0	Perched	Nov-May	>60	---	Moderate	Moderate.
CuB: Cuero	B	None	---	---	>6.0	---	---	>60	---	High	Low.
DaA: Dacosta	D	None	---	---	0-2.0	Apparent	Sep-Apr	>60	---	High	Low.
DeB*:											
Denhawken	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Elmendorf	D	None	---	---	>6.0	---	---	>60	---	High	Low.
DhA: Dietrich	C	None	---	---	0-2.0	Perched	Sep-May	>60	---	High	Moderate.
DnB: Dubina	C	None	---	---	1.0-2.0	Perched	Nov-Mar	>60	---	High	Low.
DuC: Dutek	A	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
EdA: Edna	D	None	---	---	0-1.5	Perched	Dec-Mar	>60	---	High	Low.
FbB: Falba	D	None	---	---	0-1.5	Perched	Oct-May	30-50	Soft	High	Moderate.
FnB: Flatonia	D	None	---	---	>6.0	---	---	40-60	Soft	High	Low.
FrB: Fordtran	C	None	---	---	0-3.5	Perched	Nov-Apr	>60	---	High	Moderate.
FsB, FsC, FsD: Frelsburg	D	None	---	---	>6.0	---	---	>60	---	High	Low.
GrB, GrC: Greenvine	D	None	---	---	>6.0	---	---	30-50	Soft	High	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hard-ness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
GrD4*:											
Greenvine	D	None	---	---	>6.0	---	---	30-50	Soft	High	Low.
Gullied land	D	None	---	---	>6.0	---	---	>60	---	Low	High.
HaB Hallettsville	D	None	---	---	>6.0	---	---	>60	---	High	Low.
InB Inez	D	None	---	---	0-1.5	Perched	Nov-Mar	>60	---	High	Low.
KuC Kuy	A	None	---	---	3.0-5.0	Apparent	Nov-May	>60	---	High	Moderate.
LaA Lake Charles	D	None	---	---	0-2.0	Apparent	Dec-Feb	>60	---	High	Low.
LtC3, LtD4 Latium	D	None	---	---	>6.0	---	---	>60	---	High	Low.
MbB Milby	B	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	Low	Moderate.
McA*:											
Morales	D	None	---	---	0-1.5	Perched	Nov-May	>60	---	High	High.
Cieno	D	None	---	---	+1-1.5	Perched	Nov-May	>60	---	High	Low.
NaA*:											
Nada	D	None	---	---	0-1.0	Perched	Nov-May	>60	---	High	Low.
Cieno	D	None	---	---	+1-1.5	Perched	Nov-May	>60	---	High	Low.
Nc Navaca	D	Frequent	Brief	Sep-May	2.5-5.0	Apparent	Nov-Apr	>60	---	High	Low.
NvB Navidad	B	Occasional	Brief	Sep-May	>6.0	---	---	>60	---	High	Low.
Pe Pulexas	B	Frequent	Brief	Sep-May	>6.0	---	---	>60	---	Low	Low.
Pu Pursley	B	Frequent	Brief	Sep-May	>6.0	---	---	>60	---	Moderate	Low.
StC Straber	C	None	---	---	1.5-2.5	Apparent	Sep-May	>60	---	High	High.
StD4*:											
Straber	C	None	---	---	1.5-2.5	Apparent	Sep-May	>60	---	High	High.
Gullied land	D	None	---	---	>6.0	---	---	>60	---	Low	High.
TeA Telferner	D	None	---	---	0-2.0	Perched	Nov-Mar	>60	---	High	Low.
TrC Tremona	C	None	---	---	1.5-3.5	Perched	Sep-May	>60	---	High	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL ANALYSES OF SELECTED SOILS

(Dashes indicate that data were not available. Location of pedon sampled is the same as that given for the typical pedon in "Soil Series and Their Morphology")

Soil name and sample number	Depth	Horizon	Particle-size distribution (Percent less than 2 mm)								COLE	Bulk density 1/3 bar	Water content 1/3 bar
			Sand						Silt (0.05-0.002 mm)	Clay (<0.002 mm)			
			Very coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2-0.05 mm)					
	In										Cm/cm	g/cc	Pct (wt)
Bleiblerville*, **: (S83TX285-3)	0- 6	Ap	0.1	1.1	4.7	8.7	4.1	18.7	24.2	57.1	0.15	1.18	38.0
	6-18	Bw1	0.1	0.9	3.7	7.5	3.8	16.0	18.3	65.7	0.18	1.13	41.6
	18-29	Bw2	0.1	0.6	4.0	7.3	3.4	15.4	17.3	67.3	0.18	1.17	39.6
	29-39	Bw3	0.4	0.9	3.2	6.3	3.2	14.0	17.7	68.3	0.19	1.16	43.6
	39-47	Bk	0.8	1.3	3.3	6.1	3.1	14.6	18.9	66.5	0.20	1.11	48.2
	47-54	BC	0.2	0.4	1.9	4.2	2.6	9.3	21.6	69.1	0.21	1.13	46.3
	54-72	CB	0.1	0.0	1.8	4.7	2.8	9.4	17.1	73.5	0.19	1.14	45.4
	72-80	C	0.0	0.0	1.2	4.0	3.5	8.7	18.1	73.2	0.20	1.18	43.7
Branyon**: (S83TX285-1)	0- 6	Ap	0.1	0.2	1.4	9.4	7.2	18.3	30.5	51.2	0.18	1.06	46.8
	6-20	A	0.1	0.2	1.0	8.2	7.1	16.6	28.4	55.0	0.16	1.17	39.5
	20-32	Bw	0.0	0.2	1.1	8.6	7.6	17.5	27.8	54.7	0.15	1.19	38.7
	32-45	Bk1	0.4	0.5	1.5	11.2	7.8	21.4	31.3	47.3	0.15	1.24	36.8
	45-55	Bk2	1.9	1.3	2.9	15.9	8.1	30.1	29.1	40.8	0.10	1.40	28.6
	55-65	2Bk3	0.2	0.6	6.3	36.3	18.5	61.9	15.8	22.3	0.05	1.56	19.4
	65-80	2Bk4	0.4	2.0	13.1	38.9	10.2	64.6	11.6	23.8	0.06	1.51	24.0
Frelsburg**: (S83TX285-2)	0- 8	A	0.2	1.2	5.5	11.4	4.1	22.4	28.2	49.4	0.15	1.05	48.4
	8-20	Bw1	0.5	1.3	4.6	9.5	3.3	19.2	25.2	55.6	0.13	1.25	36.4
	20-36	Bw2	0.6	1.4	4.6	9.7	3.8	20.1	25.0	54.9	0.12	1.35	33.1
	36-52	Bk1	2.5	2.3	3.9	8.3	3.2	20.2	26.7	53.1	0.13	1.32	35.0
	52-61	Bk2	2.1	2.1	4.4	9.0	3.5	21.1	27.6	51.3	0.13	1.31	35.1
	61-71	Bk3	1.7	2.3	4.4	10.2	3.7	22.3	23.3	54.4	0.14	1.28	36.1
	71-80	BCk	0.3	0.8	4.0	10.9	3.8	19.8	30.8	49.4	0.13	1.38	31.8
Greenvine**: (S83TX285-6)	0- 6	Ap	0.1	0.9	5.6	18.4	13.4	38.4	25.6	36.0	0.14	1.14	40.7
	6-13	A	0.1	0.5	3.0	13.4	9.7	26.7	25.0	48.3	0.16	1.13	44.5
	13-20	Bw	0.0	0.6	3.5	12.6	9.3	26.0	22.9	51.1	0.18	1.12	47.4
	20-28	Bk1	0.4	0.5	1.6	6.0	6.0	14.5	26.5	59.0	---	---	---
	28-35	Bk2	2.3	2.4	1.9	3.5	5.3	15.4	35.7	48.9	---	---	---
	35-48	Bk3	0.2	0.2	0.3	2.0	5.6	8.3	42.1	49.6	---	---	---
	48-67	Crk	0.4	0.5	0.5	2.8	8.1	12.3	49.1	38.6	---	---	---

See footnotes at end of table.

TABLE 17--PHYSICAL ANALYSES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution (Percent less than 2 mm)								COLE	Bulk density 1/3 bar	Water content 1/3 bar
			Sand						Silt (0.05-0.002 mm)	Clay (<0.002 mm)			
			Very coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2-0.05 mm)					
	In										Cm/cm	g/cc	Pct (wt)
Hallettsville***:													
(S82TX285-1)	0- 8	A	---	0.7	10.3	31.5	20.2	62.7	18.9	18.4	0.03	1.59	17.2
	8-13	Bt1	0.1	0.9	7.6	21.0	14.2	43.8	14.1	42.1	0.11	1.33	31.4
	13-26	Bt2	0.1	0.8	7.9	22.1	15.4	46.3	15.8	37.9	0.08	1.56	23.4
	26-35	Bt3	---	0.7	8.2	23.5	15.6	48.0	17.2	34.8	0.08	1.57	22.6
	35-45	Btk1	0.4	1.1	8.6	23.6	16.5	50.2	16.0	33.8	0.08	1.56	23.6
	45-54	Btk2	0.4	0.7	8.1	23.4	19.6	52.2	14.5	33.3	0.07	1.50	25.4
	54-64	2BC1	---	0.5	11.1	27.0	23.2	61.8	9.2	29.0	0.04	1.57	19.5
	64-74	2BC2	---	0.5	21.8	38.5	12.9	73.7	5.7	20.6	0.02	1.68	13.6
	74-80	2C	---	0.3	30.9	44.1	6.8	82.1	2.7	15.2	0.02	1.65	12.8
Straber***:													
(S82TX285-3)	0- 7	A	1.1	8.9	35.1	34.6	8.0	87.7	9.8	2.5	---	1.70	---
	7-14	E	1.9	10.5	32.3	34.6	8.3	87.6	10.0	2.4	---	1.70	---
	14-23	Bt1	1.1	5.6	18.9	14.6	3.0	43.2	4.4	52.4	0.07	1.45	25.3
	23-34	Bt2	0.9	6.5	20.9	18.2	3.9	50.4	5.1	44.5	0.07	1.56	22.8
	34-52	Btg	1.6	6.4	23.4	21.5	4.9	57.8	6.5	35.7	0.07	1.71	19.4
	52-62	BCg	4.5	15.0	26.6	19.5	4.0	69.6	5.0	25.4	0.04	1.83	15.2
	62-80	Cg	2.8	12.2	31.4	20.9	3.9	71.2	3.6	25.2	0.04	1.76	17.9

* This Bleiblerville pedon is a taxadjunct to the Bleiblerville series because the clay content exceeds 60 percent in the control section.

** Data determined by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

*** Data determined by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

TABLE 18.--CHEMICAL ANALYSES OF SELECTED SOILS

(Dashes indicate that data were not available. Location of pedon sampled is the same as that given for the typical pedon in "Soil Series and Their Morphology")

Soil name and sample number	Horizon	Depth	Extractable bases: Ca	Mg	Na	K	Sum	Cation-exchange capacity	Electrical conduc-tivity	Base satura-tion	Organic carbon	pH (1:1 H_2O)	$CaCO_3$	Exchange-able sodium
		In	Meq/100g						Mmhos/cm	Pct	Pct		Pct	Pct
Bleiblerville*, **: (S83TX285-3)	Ap	0- 6	87.1	2.7	0.5	1.1	91.5	62.1	0.5	100	1.65	7.7	5.1	1
	Bw1	6-18	89.7	3.3	2.3	0.8	96.0	66.5	0.5	100	1.29	7.8	6.5	3
	Bw2	18-29	90.5	4.0	5.1	0.8	100.3	65.3	0.6	100	1.05	7.8	7.6	7
	Bw3	29-39	86.9	4.5	6.7	0.7	98.9	67.5	0.8	100	1.04	7.8	8.8	9
	Bk	39-47	84.8	4.6	9.0	0.9	99.3	66.0	1.8	100	0.56	7.9	12.3	12
	BC	47-54	88.6	5.1	11.6	0.8	106.0	69.1	4.0	100	0.29	7.6	8.4	12
	CB	54-72	99.4	5.5	12.4	0.5	117.8	76.0	5.8	100	0.05	7.3	0.6	11
	C	72-80	72.0	5.5	13.3	0.6	91.5	71.9	6.3	100	0.01	7.3	0.7	13
Branyon**: (S83TX285-1)	Ap	0- 6	76.9	2.0	0.2	1.0	80.2	54.1	---	100	2.37	7.0	9.6	0
	A	6-20	79.6	1.8	0.3	0.8	82.6	49.4	---	100	1.47	7.6	13.7	1
	Bw	20-32	82.7	2.0	1.3	0.7	86.7	47.5	---	100	1.26	7.6	14.2	3
	Bk1	32-45	73.1	1.9	2.1	0.5	77.6	41.1	---	100	0.98	7.8	18.2	5
	Bk2	45-55	64.8	1.5	2.4	0.4	69.1	35.1	0.6	100	0.67	7.9	19.4	6
	2Bk3	55-65	50.6	0.9	1.5	0.2	53.3	19.0	0.7	100	0.26	8.2	4.1	7
	2Bk4	65-80	46.7	1.2	1.8	0.2	50.0	22.0	0.7	100	0.23	8.2	2.0	7
Frelsburg**: (S83TX285-2)	A	0- 8	88.8	2.0	0.2	0.4	91.4	56.2	---	100	2.56	7.6	8.6	0
	Bw1	8-20	82.6	2.1	0.8	0.3	85.8	51.8	0.4	100	0.92	7.8	17.9	1
	Bw2	20-36	79.9	2.8	3.3	0.3	86.4	47.9	0.5	100	0.65	7.9	19.3	6
	Bk1	36-52	75.0	3.2	6.3	0.2	84.7	46.8	1.2	100	0.67	8.0	22.0	12
	Bk2	52-61	71.6	3.3	8.1	0.5	83.6	44.7	2.4	100	0.55	7.9	18.8	15
	Bk3	61-71	70.6	3.7	10.1	0.6	85.1	50.3	3.7	100	0.42	7.8	10.8	16
	BCk	71-80	63.8	3.1	8.1	0.5	75.5	40.5	3.6	100	0.26	7.9	23.5	15
Greenvine**: (S83TX285-4)	Ap	0- 6	35.6	1.3	0.1	0.8	37.9	34.6	---	100	1.36	7.2	0.4	0
	A	6-13	57.4	1.2	0.1	0.9	59.6	46.2	---	100	1.09	7.4	1.5	0
	Bw	13-20	68.4	1.4	0.2	0.8	70.8	44.2	---	100	0.97	7.4	1.0	0
	Bk1	20-28	65.8	1.2	0.2	0.8	68.0	41.3	---	100	0.93	7.4	17.6	1
	Bk2	28-35	67.7	1.5	0.2	0.7	70.1	30.4	---	100	0.52	7.6	40.9	1
	Bk3	35-48	81.8	2.0	0.2	1.3	85.3	42.5	---	100	0.29	7.5	10.1	1
	Crk	48-67	85.2	2.2	0.3	1.2	88.9	44.6	---	100	0.23	7.4	6.7	1

See footnotes at end of table.

TABLE 18.--CHEMICAL ANALYSES OF SELECTED SOILS--Continued

Soil name and sample number	Horizon	Depth	Extractable bases: Ca	Mg	Na	K	Sum	Cation-exchange capacity	Electrical conductivity	Base saturation	Organic carbon	pH (1:1 H_2O)	$CaCO_3$	Exchangeable sodium
		In	Meq/100g						Mmhos/cm	Pct	Pct		Pct	Pct
Hallettsville***: (S82TX285-1)														
	A	0- 8	15.2	2.1	0.4	0.3	18.0	17.8	0.2	100	1.27	6.9	---	---
	Bt1	8-13	25.9	6.2	1.8	0.5	34.4	37.1	0.1	93	0.86	6.9	---	---
	Bt2	13-26	21.0	6.1	2.4	0.5	30.0	31.5	0.2	95	0.50	6.8	---	---
	Bt3	26-35	21.5	6.3	3.1	0.4	31.3	29.6	1.2	100	0.42	7.1	---	7
	Btk1	35-45	25.8	6.1	3.5	0.4	35.8	27.2	2.5	100	0.30	7.9	T	12
	Btk2	45-54	26.0	6.3	3.8	0.5	36.6	27.7	3.3	100	0.20	7.9	T	9
	2BC1	54-64	19.7	5.2	3.3	0.5	28.7	24.0	3.3	100	0.14	7.9	T	10
	2BC2	64-74	13.1	3.3	2.1	0.3	18.8	17.0	3.5	100	0.12	7.5	T	8
	2C	74-80	8.8	2.0	1.4	0.3	12.5	11.6	3.5	100	0.09	6.6	---	12
Straber***: (S82TX285-3)														
	A	0- 7	2.1	0.1	T	0.1	2.3	2.1	---	100	0.54	6.0	---	---
	E	7-14	0.8	---	T	T	0.8	0.7	---	100	0.16	6.7	---	---
	Bt1	14-23	11.8	4.0	0.8	0.3	16.9	21.8	0.1	78	0.40	5.3	---	---
	Bt2	23-34	10.4	3.9	1.0	0.3	15.6	19.8	0.1	79	0.29	5.1	---	---
	Btg	34-52	11.5	4.2	2.8	0.3	18.8	18.3	0.2	100	0.17	5.2	---	---
	BCg	52-62	11.3	3.6	1.7	0.3	16.9	17.7	0.2	95	0.10	5.5	---	---
	Cg	62-80	11.9	3.6	2.2	0.3	18.0	17.7	2.3	100	0.12	6.3	---	9

* This Bleiblerville pedon is a taxadjunct to the Bleiblerville series because the clay content exceeds 60 percent in the control section.

** Data determined by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

*** Data determined by Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

TABLE 19.--CLAY MINERALOGY OF SELECTED SOILS

(Dashes indicate that data were not available. Location of pedon sampled is the same as that given for the typical pedon in "Soil Series and Their Morphology")

Soil name and sample number	Depth	Horizon	Percentage of clay minerals* (x-ray diffraction)				
			Smectite	Mica	Kaolinite	Quartz	Goethite
	In						
Bleiblerville**, ***:	0- 6	Ap	>50	---	<10	<10	---
(S83TX285-3)	18-29	Bw2	>50	---	<10	<10	---
	72-80	C	>50	---	<10	<10	---
Branyon***:	0- 6	Ap	>50	---	<10	<10	---
(S83TX285-1)	20-32	Bw	>50	---	<10	<10	---
	65-80	2Bk4	>50	---	<10	<10	---
Frelsburg***:	0- 8	A	>50	---	<10	<10	---
(S83TX285-2)	20-36	Bw2	>50	---	<10	<10	---
	71-80	BCk	>50	---	<10	<10	---
Greenvine***:	0- 6	Ap	>50	---	<10	<10	---
(S83TX285-4)	13-20	Bw	>50	---	<10	<10	---
	48-67	Crk	>50	---	<10	<10	---
Hallettsville****:	13-26	Bt2	5	2	3	1	---
(S82TX285-1)	54-64	2BC1	5	2	3	1	---
	74-80	2C	5	2	3	1	---
Straber****:	14-23	Bt1	3	1	4	1	1
(S82TX285-3)	62-80	Cg	5	1	3	1	---

* Clay minerals for Halletsville and Straber soils are given as relative amounts, as follows: 1--trace; 2--small; 3--moderate; 4--abundant; and 5--dominant.

** This Bleiblerville pedon is a taxadjunct to the Bleiblerville series because the clay content exceeds 60 percent in the control section.

*** Data determined by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

**** Data determined by the Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebraska.

TABLE 20.--ENGINEERING INDEX TEST DATA

(Dashes include that data that were not available)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution						Liquid limit	Plasticity index	Specific gravity	Shrinkage		
			Percentage passing sieve--			Percentage smaller than--								
	AASHTO	Unified	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
									Pct			Pct	Pct	
Bleiblerville clay*:														
(S83TX285-5)														
Ap--------- 0 to 6	A-7-6(47)	CH	100	99	82	79	65	60	82	49	2.65	12	25.2	2.03
Bw2------- 18 to 29	A-7-6(51)	CH	100	98	82	78	66	59	83	55	2.71	17	24.5	1.86
Cuero sandy clay loam**:														
(S83TX285-7)														
A---------- 0 to 16	A-2-6(2)	SC	100	97	41	34	30	25	33	14	2.60	18	7.6	1.77
Bt2------- 21 to 26	A-7-6(6)	SC	100	95	45	45	40	38	45	21	2.68	17	12.7	1.82
C2-------- 54 to 80	A-2-6(0)	SC	100	88	34	32	16	15	28	12	2.66	17	6.1	1.82
Dutek loamy fine sand*:														
(S83TX285-9)														
A---------- 0 to 10	A-2-4(6)	SP-SM	100	87	9	6	3	3	20	3	2.62	18	0.0	1.67
Bt1------- 28 to 38	A-6(2)	SC	100	94	36	33	28	27	39	19	2.67	18	9.9	1.79
2C-------- 65 to 80	A-2-4(0)	SM	100	86	13	10	9	9	22	3	2.70	21	0.5	1.71
Flatonia clay loam*:														
(S83TX285-8)														
A---------- 0 to 6	A-7-6(10)	CL	100	98	54	49	33	30	46	24	2.73	16	13.2	1.83
Bt2------- 27 to 35	A-7-6(19)	CH	100	98	64	59	41	37	54	31	2.71	14	17.7	1.93
Cr-------- 48 to 80	A-7-6(10)	CL	---	100	56	45	30	25	42	24	2.65	11	11.1	1.84
Frelsburg clay*:														
(S83TX285-4)														
A---------- 0 to 8	A-7-6(45)	CH	100	99	88	82	61	53	83	41	2.57	18	22.0	1.73
Bw2------- 20 to 36	A-7-6(52)	CH	100	98	85	79	66	58	82	54	2.69	11	26.0	2.09
Greenvine clay*:														
(S83TX285-6)														
Ap--------- 0 to 6	A-7-6(27)	CH	100	99	73	65	48	42	62	33	2.62	12	19.0	1.93
Bk1------- 20 to 28	A-7-6(57)	CH	---	100	89	83	72	62	88	55	2.67	14	25.4	1.94

See footnotes at end of table.

TABLE 20.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification: AASHTO	Classification: Unified	Grain-size distribution: Percentage passing sieve-- No. 10	No. 40	No. 200	Percentage smaller than-- .05 mm	.005 mm	.002 mm	Liquid limit	Plasticity index	Specific gravity	Shrinkage: Limit	Shrinkage: Linear	Shrinkage: Ratio
									Pct			Pct	Pct	
Hallettsville fine sandy loam*:														
(S82TX285-1)														
A---------- 0 to 8	A-6(2)	SC	100	99	48	36	21	16	29	11	2.65	15	7.7	1.90
Bt2------- 13 to 26	A-7-6(18)	CH	100	98	61	54	40	37	52	33	2.65	16	15.6	1.86
2C-------- 74 to 80	A-2-4(0)	SC	100	99	27	23	18	17	31	9	2.68	22	5.0	1.71
Inez loamy fine sand*:														
(S84TX285-11)														
A---------- 0 to 10	A-2-4(0)	SM	100	94	22	18	8	7	16	2	2.61	14	0.0	1.84
Btg2------ 26 to 41	A-7-6(11)	CL	---	100	51	49	40	40	45	29	2.64	17	13.2	1.88
BCg------- 53 to 80	A-6(9)	SC	---	100	49	52	36	33	38	25	2.62	16	11.2	1.92
Kuy loamy fine sand*:														
(S84TX285-12)														
E2-------- 13 to 52	A-2-4(0)	SP-SM	---	100	6	6	6	5	23	3	2.61	20	0.0	1.66
Btg------- 52 to 80	A-6(2)	SC	---	100	36	34	30	30	39	21	2.64	20	8.9	1.73
Navaca clay*:														
(S84TX285-13)														
A1--------- 0 to 16	A-7-6(41)	CH	---	100	97	86	60	52	62	35	2.63	18	17.8	1.82
2C1------- 31 to 45	A-2-4(0)	SP-SM	---	100	12	12	10	10	20	2	2.60	20	0.0	1.71
Navidad fine sandy loam*:														
(S83TX285-10)														
Ap--------- 0 to 6	A-2-4(0)	SM-SC	---	100	21	13	12	9	25	6	2.64	22	1.6	1.67
A---------- 6 to 38	A-2-4(0)	SM-SC	---	100	15	14	10	8	23	5	2.66	20	1.5	1.73
C2-------- 55 to 80	A-2-4(0)	SM-SC	---	100	21	18	10	9	22	4	2.65	19	1.8	1.75

* Location of pedon sampled is the same as that given for the typical pedon in "Soil Series and Their Morphology."

** Location of Cuero sandy clay loam: from Farm Road 1295 in Witting, 1.0 mile northeast on Farm Road 340, 1.55 miles southeast on unpaved road, and 100 feet southeast in pasture.

TABLE 21.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
*Bleiblerville	Fine, montmorillonitic, thermic Udic Pellusterts
Branyon	Fine, montmorillonitic, thermic Udic Pellusterts
Carbengle	Fine-loamy, carbonatic, thermic Typic Calciustolls
Catilla	Loamy, siliceous, thermic Grossarenic Paleustalfs
Cieno	Fine-loamy, siliceous, hyperthermic Typic Ochraqualfs
Cuero	Fine-loamy, mixed, thermic Pachic Argiustolls
Dacosta	Fine, montmorillonitic, hyperthermic Vertic Ochraqualfs
Denhawken	Fine, montmorillonitic, hyperthermic Vertic Ustochrepts
Dietrich	Fine-loamy, mixed, hyperthermic Typic Natraqualfs
Dubina	Fine, montmorillonitic, thermic Aquic Paleustolls
Dutek	Loamy, siliceous, thermic Arenic Haplustalfs
Edna	Fine, montmorillonitic, thermic Vertic Albaqualfs
Elmendorf	Fine, montmorillonitic, hyperthermic Vertic Argiustolls
*Falba	Fine, montmorillonitic, thermic Typic Albaqualfs
Flatonia	Fine, montmorillonitic, thermic Vertic Argiustolls
Fordtran	Clayey, mixed, hyperthermic Arenic Albaqualfs
Frelsburg	Fine, montmorillonitic, thermic Udorthentic Pellusterts
*Greenvine	Fine, montmorillonitic, thermic Udic Pellusterts
Hallettsville	Fine, montmorillonitic, thermic Udertic Paleustolls
Inez	Fine, montmorillonitic, hyperthermic Typic Albaqualfs
Kuy	Loamy, siliceous, hyperthermic Grossarenic Paleudalfs
Lake Charles	Fine, montmorillonitic, thermic Typic Pelluderts
Latium	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Milby	Loamy, siliceous, hyperthermic Arenic Paleudalfs
Morales	Fine-loamy, siliceous, hyperthermic Aeric Glossaqualfs
Nada	Fine-loamy, siliceous, hyperthermic Typic Albaqualfs
Navaca	Clayey over loamy, montmorillonitic, thermic Udertic Haplustolls
Navidad	Coarse-loamy, siliceous, hyperthermic Cumulic Haplustolls
Pulexas	Coarse-loamy, siliceous, nonacid, thermic Typic Ustifluvents
Pursley	Fine-loamy, mixed, thermic Fluventic Haplustolls
Straber	Fine, mixed, thermic Aquic Paleustalfs
Telferner	Fine, montmorillonitic, hyperthermic Typic Albaqualfs
Tremona	Clayey, mixed, thermic Aquic Arenic Paleustalfs

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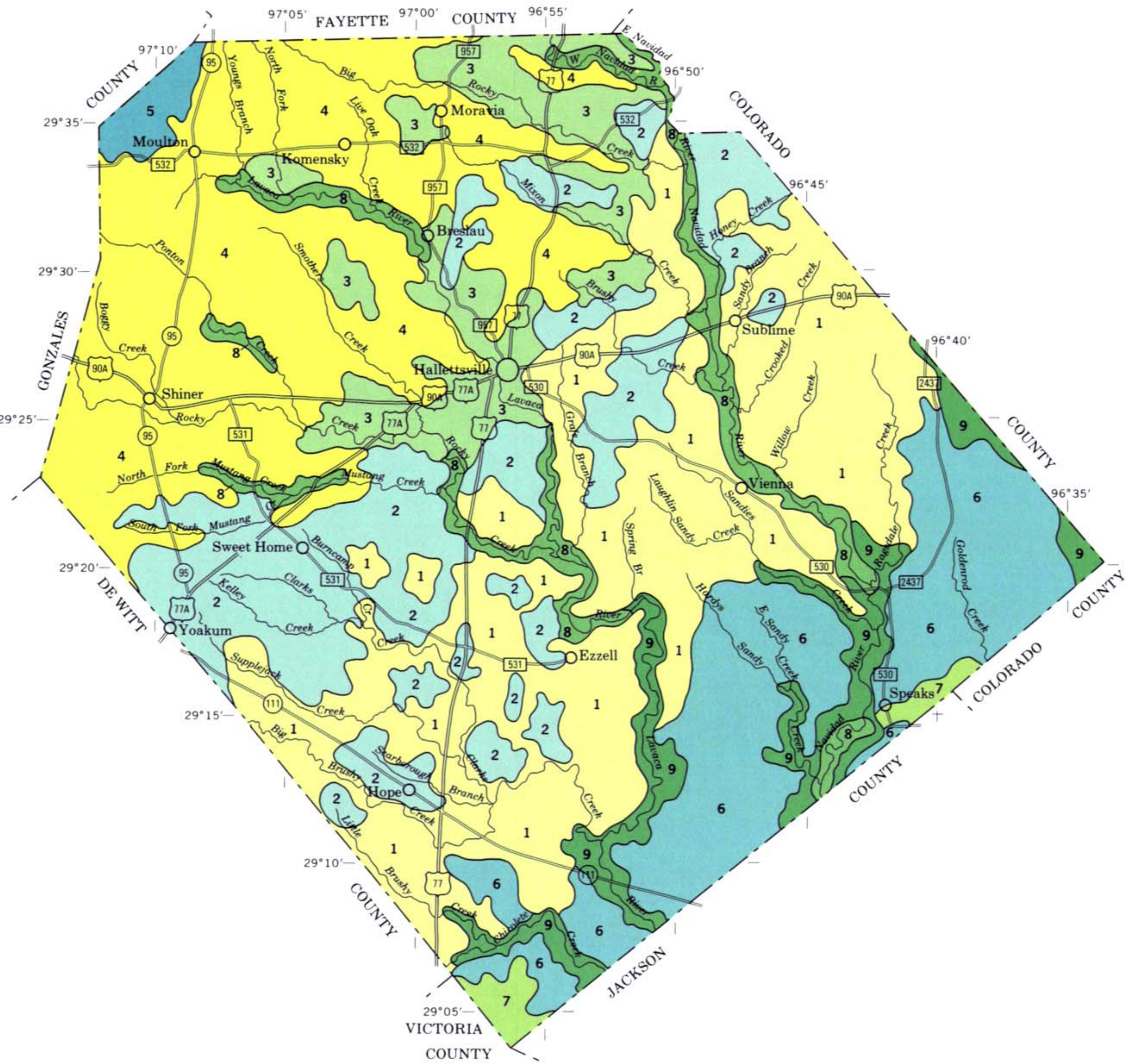


LEGEND *

DOMINANTLY GENTLY SLOPING, SANDY AND LOAMY SOILS OF THE TEXAS CLAYPAN AREA

1	STRABER-TREMONA: Somewhat poorly drained, very slowly permeable, sandy soils; on uplands
2	DENHAWKEN-ELMENDORF-HALLETTSVILLE: Well drained and moderately well drained, very slowly permeable, loamy soils; on uplands
3	DUBINA-HALLETTSVILLE-STRABER: Moderately well drained and somewhat poorly drained, slowly permeable and very slowly permeable, sandy and loamy soils; on uplands

DOMINANTLY GENTLY SLOPING TO STRONGLY SLOPING, LOAMY AND CLAYEY SOILS OF THE TEXAS BLACKLAND PRARIE

4	CARBENGLE-FRELSBURG: Well drained, moderately permeable and very slowly permeable, loamy and clayey soils; on uplands
5	GREENVINE-FLATONIA: Moderately well drained, very slowly permeable and slowly permeable, loamy soils; on uplands

DOMINANTLY NEARLY LEVEL, LOAMY AND SANDY SOILS OF THE GULF COAST PRARIES

6	INEZ-MORALES-CIENO: Somewhat poorly drained and poorly drained, very slowly permeable and slowly permeable, loamy and sandy soils; on uplands
7	TELFERNER: Somewhat poorly drained, very slowly permeable, loamy soils; on uplands

DOMINANTLY NEARLY LEVEL TO GENTLY SLOPING, CLAYEY, LOAMY, AND SANDY SOILS ON FLOOD PLAINS AND TERRACES

8	NAVACA-BRANYON-NAVIDAD: Moderately well drained and well drained, very slowly permeable and moderately rapidly permeable, clayey and loamy soils; on bottom lands and terraces
9	MILBY-KUY-DUTEK: Moderately well drained and well drained, slowly permeable and moderately permeable, sandy soils; on terraces

* Texture terms in the descriptive headings refer to the surface layer of the major soils.

Compiled 1986

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION
TEXAS STATE SOIL AND WATER CONSERVATION BOARD

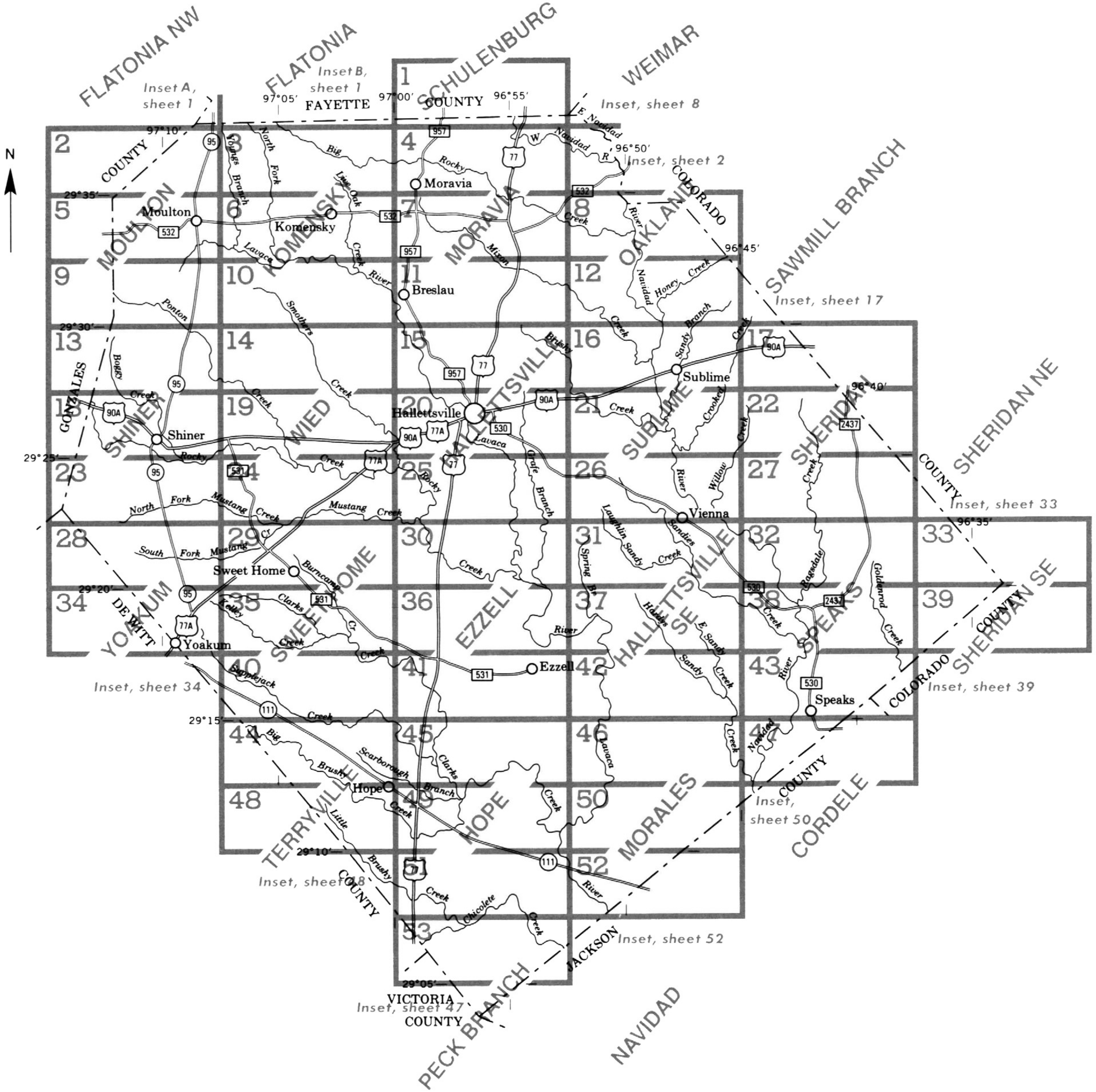
GENERAL SOIL MAP

LAVACA COUNTY, TEXAS

Scale 1:316,800

1 0 1 2 3 4 5 Mi

1 0 5 10 Km



INDEX TO MAP SHEETS
LAVACA COUNTY, TEXAS

Scale 1:316,800

1 0 1 2 3 4 5 Mi

1 0 5 10 Km

NAMES PLACED DIAGONALLY ON THIS MAP INDICATE
THE GENERAL AREA COVERED BY USGS TOPOGRAPHIC MAPS

SOIL LEGEND

Soil map publication symbols and map unit names are listed alphabetically. The first letter is always a capital letter and is the initial letter of the soil name. The second letter is a lower case letter. The third letter, if used, is a capital letter and indicates the slope class. Where the third letter is not used the slope is nearly level. The fourth symbol is a number, if used, and indicates the erosion class.

SYMBOL	NAME
BbB	Bleiblerville clay, 1 to 3 percent slopes
BrA	Branyon clay, 0 to 1 percent slopes
CaB	Carbengle loam, 1 to 3 percent slopes
CaC	Carbengle loam, 3 to 5 percent slopes
CaC3	Carbengle loam, 2 to 5 percent slopes, eroded
CaD	Carbengle loam, 5 to 8 percent slopes
CtC	Catilla loamy sand, 1 to 5 percent slopes
CuB	Cuero sandy clay loam, 1 to 3 percent slopes
DaA	Dacosta sandy clay loam, 0 to 1 percent slopes
DeB	Denhawken-Elmendorf complex, 1 to 3 percent slopes
DhA	Dietrich fine sandy loam, 0 to 1 percent slopes
DnB	Dubina loamy fine sand, 1 to 3 percent slopes
DuC	Dutek loamy fine sand, 1 to 5 percent slopes
EdA	Edna fine sandy loam, 0 to 1 percent slopes
FbB	Falba loamy fine sand, 1 to 3 percent slopes
FnB	Flatonia clay loam, 1 to 3 percent slopes
FrB	Fordtran loamy fine sand, 0 to 3 percent slopes
FsB	Freisburg clay, 1 to 3 percent slopes
FsC	Freisburg clay, 3 to 5 percent slopes
FsD	Freisburg clay, 5 to 8 percent slopes
GrB	Greenvine clay loam, 1 to 3 percent slopes
GrC	Greenvine clay loam, 3 to 5 percent slopes
GrD4	Greenvine-Gullied land complex, 3 to 8 percent slopes
HaB	Hallettsville fine sandy loam, 1 to 3 percent slopes
InB	Inez loamy fine sand, 0 to 2 percent slopes
KuC	Kuy loamy fine sand, 1 to 5 percent slopes
LaA	Lake Charles clay, 0 to 1 percent slopes
LtC3	Latium clay, 3 to 5 percent slopes, eroded
LtD4	Latium clay, 5 to 8 percent slopes, severely eroded
MbB	Milby loamy sand, 0 to 3 percent slopes
McA	Morales-Cieno complex, 0 to 1 percent slopes
NaA	Nada-Cieno complex, 0 to 1 percent slopes
Nc	Navaca clay, frequently flooded
NvB	Navidad fine sandy loam, occasionally flooded, 1 to 3 percent slopes
Pe	Pulexas fine sandy loam, frequently flooded
Pu	Pursley loam, frequently flooded
StC	Straber loamy sand, 1 to 5 percent slopes
StD4	Straber-Gullied land complex, 2 to 8 percent slopes
TeA	Telferner fine sandy loam, 0 to 1 percent slopes
TrC	Tremona loamy fine sand, 1 to 5 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Smith Airport; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate (21)
- Federal (173)
- State (28)
- County, farm or ranch (1283)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (Gas)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (BrA; FbB)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

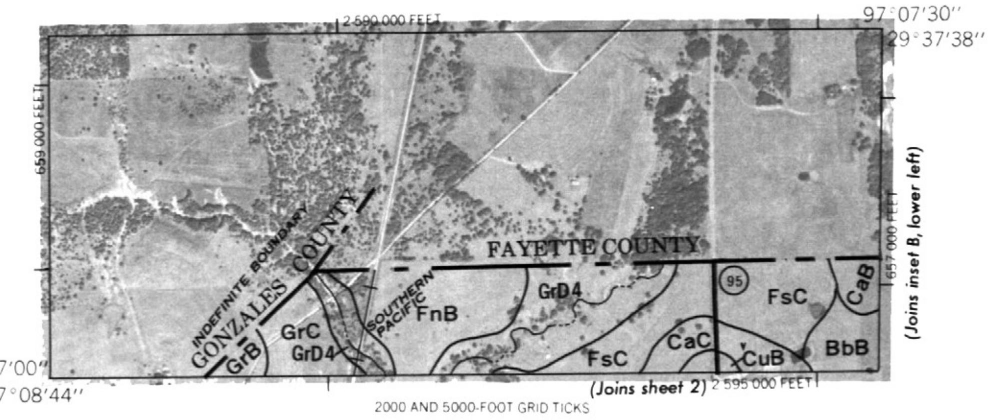
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

1

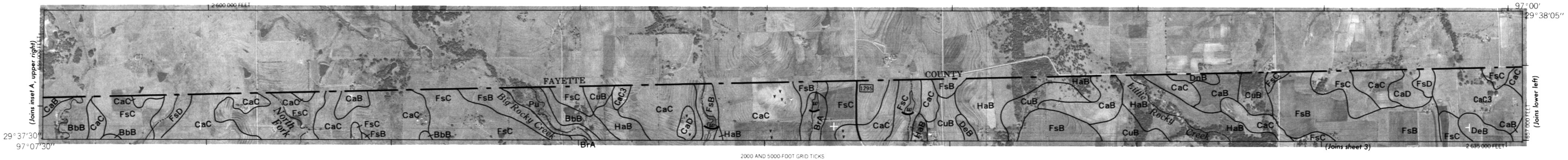
N

INSET A

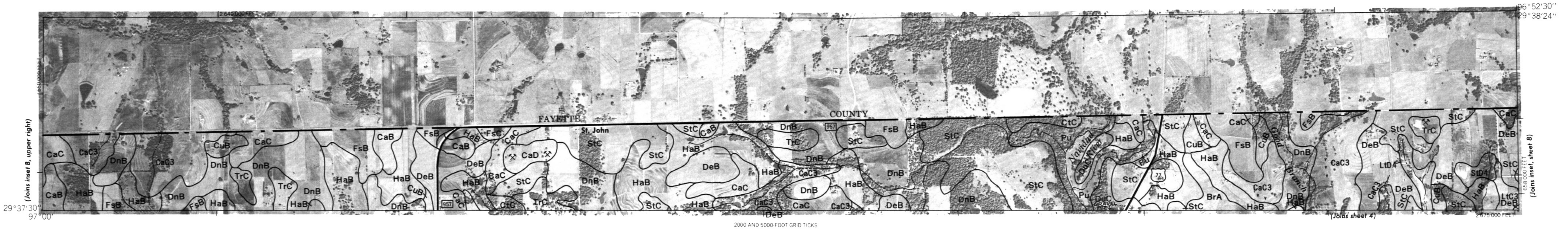


2000 AND 5000-FOOT GRID TICKS

INSET B



2000 AND 5000-FOOT GRID TICKS



2000 AND 5000-FOOT GRID TICKS

5000 4000 3000 2000 1000 0 5000 10000 Feet

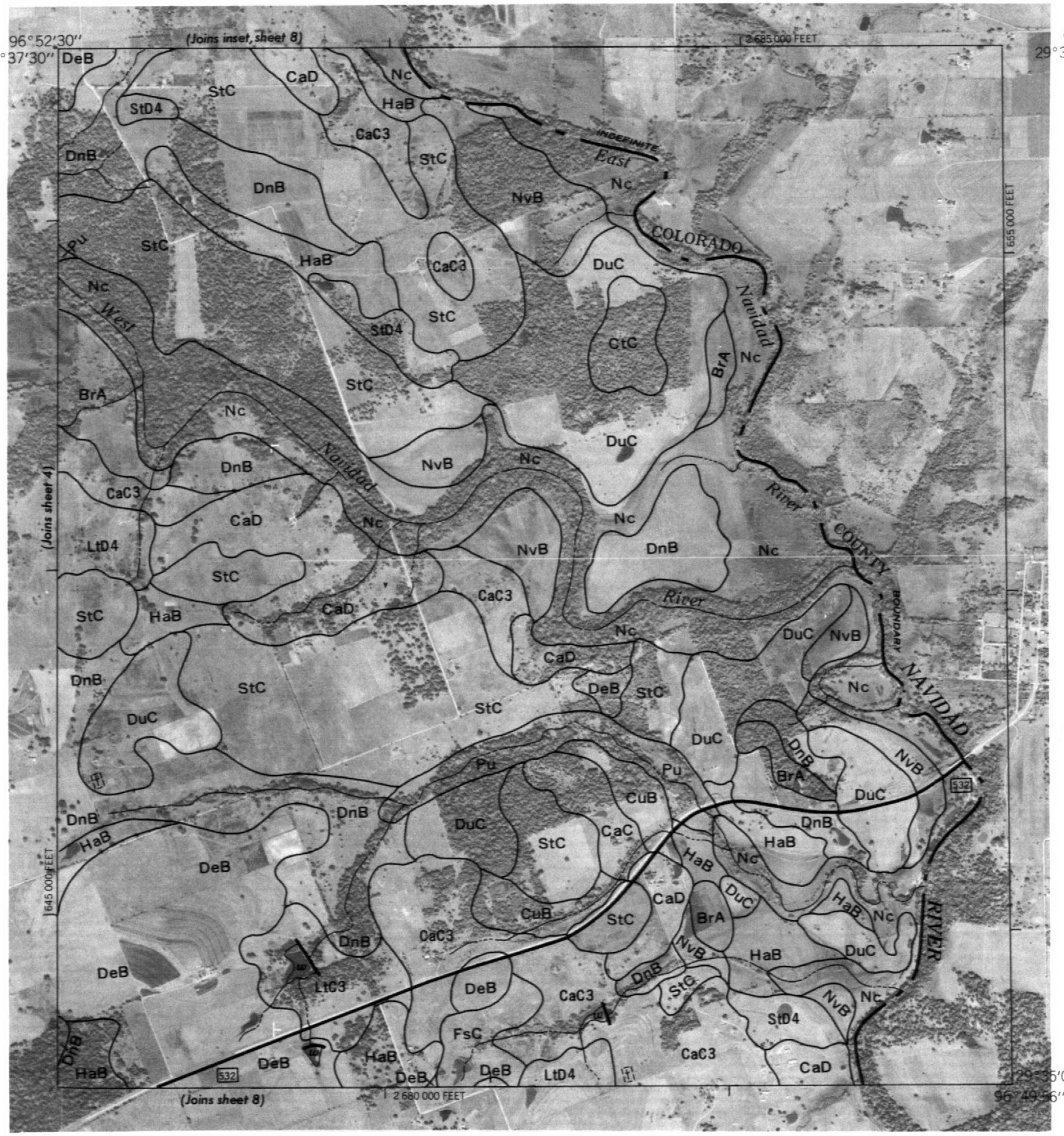
1 .5 0 1 2 3 Kilometers

Scale - 1:24000

LAVACA COUNTY, TEXAS NO. 1

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

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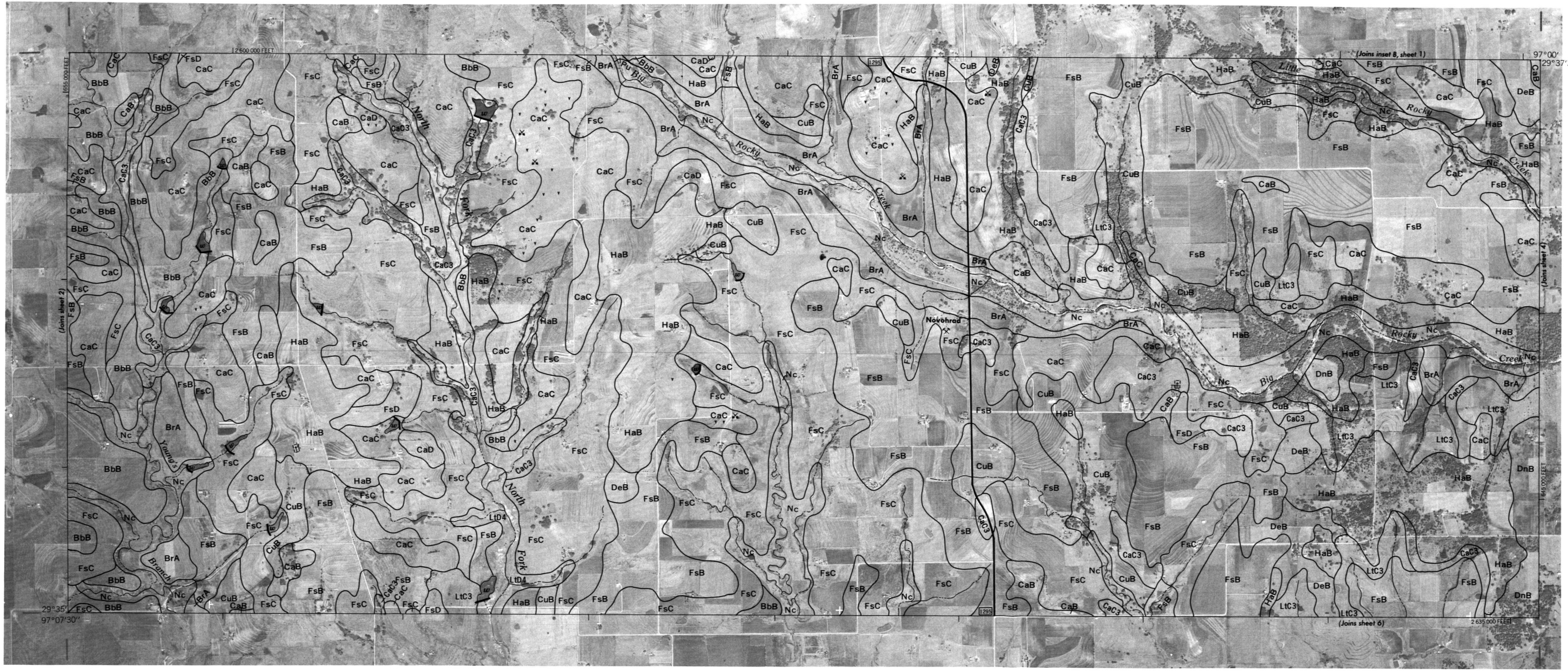
LAVACA COUNTY, TEXAS NO. 2

3

N



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

LAVACA COUNTY, TEXAS NO. 3

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N

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

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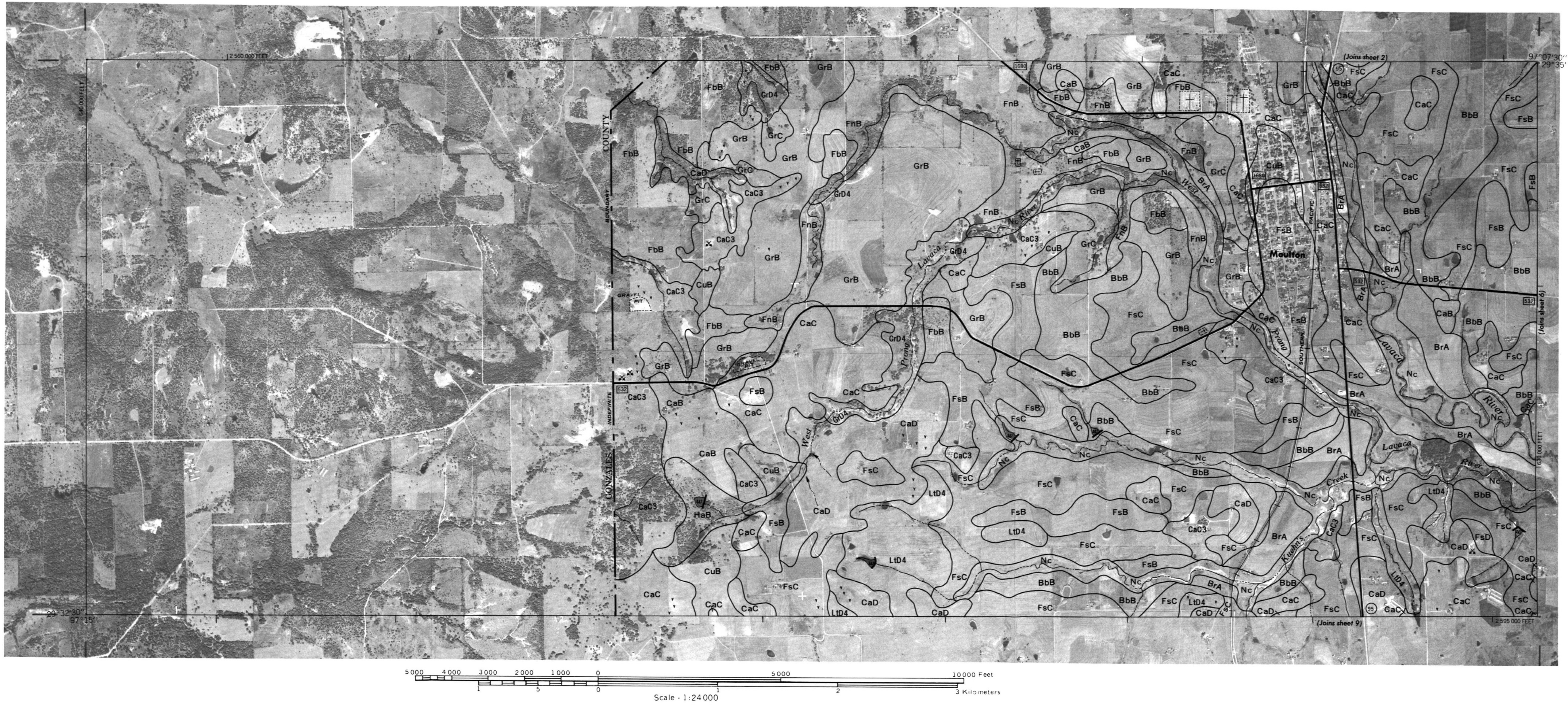
LAVACA COUNTY, TEXAS NO. 4

5

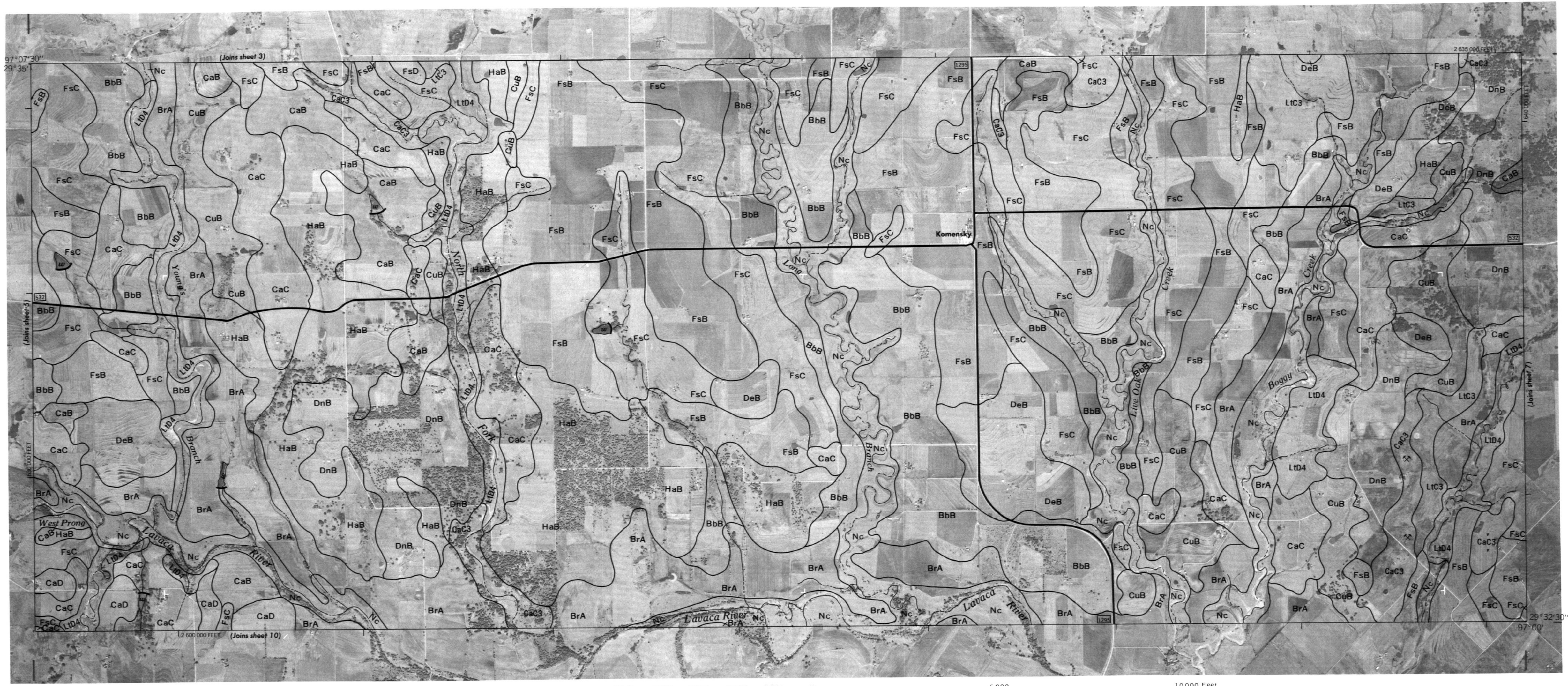
LAVACA COUNTY, TEXAS NO. 5

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



LAVACA COUNTY, TEXAS — SHEET NUMBER 6

N



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 7

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

LAVACA COUNTY, TEXAS — SHEET NUMBER 8

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

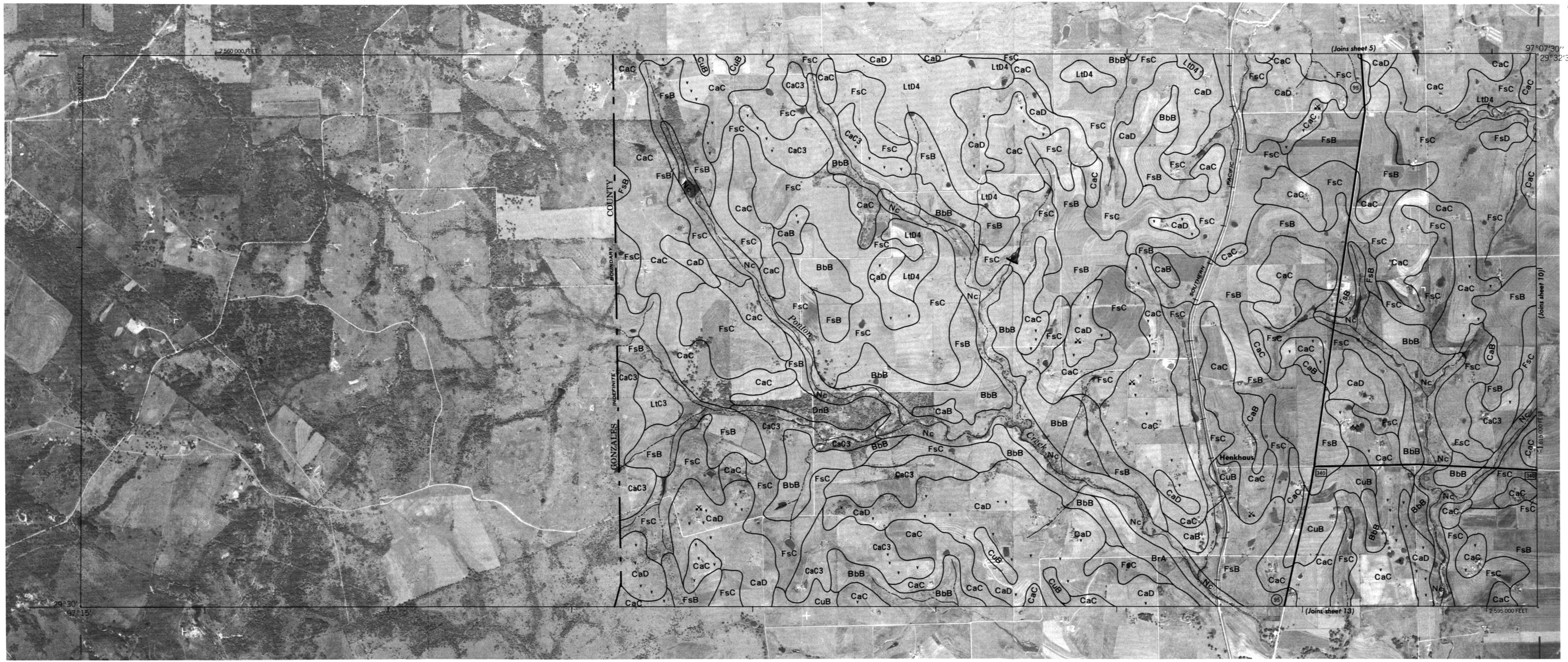
Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned

LAVACA COUNTY, TEXAS NO. 8

9

N



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

LAVACA COUNTY, TEXAS NO. 9

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned

11

N

5000 4000 3000 2000 1000 0 5000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

LAVACA COUNTY, TEXAS NO. 11

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS — SHEET NUMBER 12

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

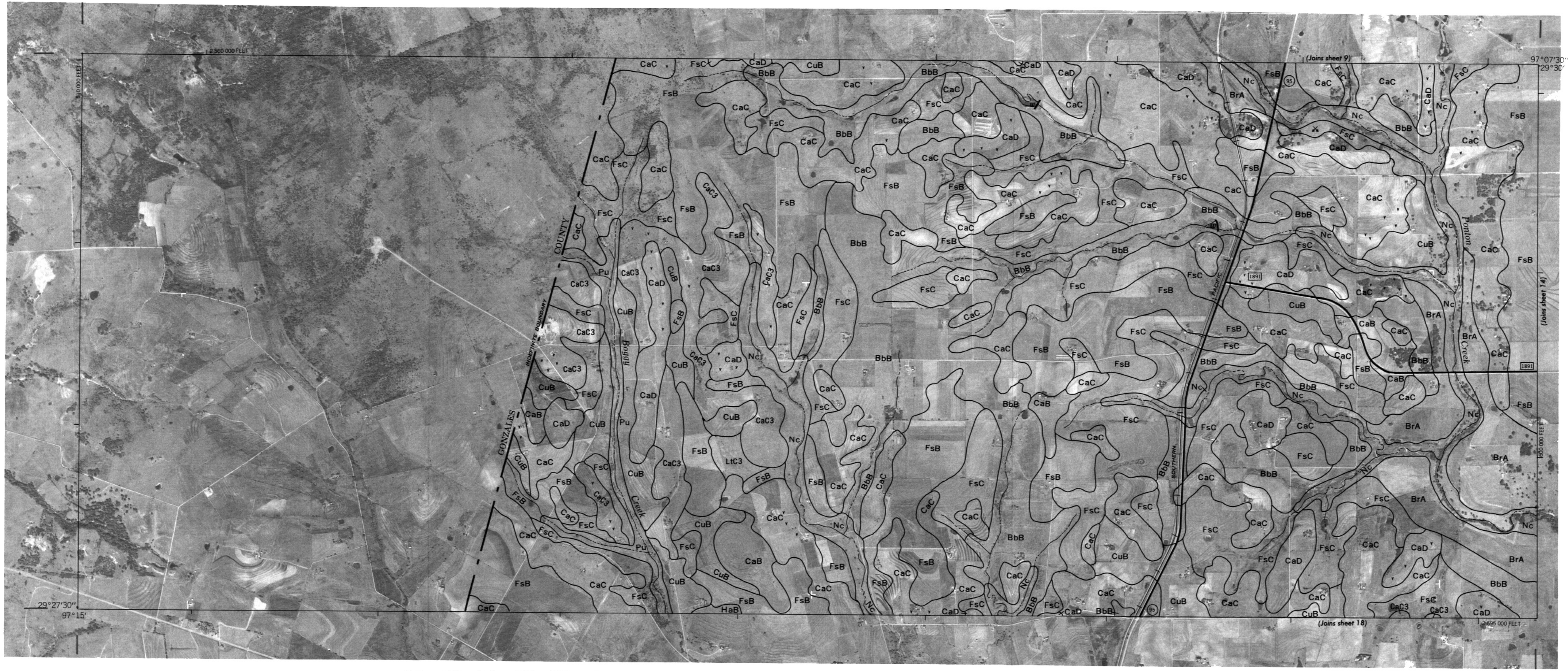
LAVACA COUNTY, TEXAS NO. 12

13

N

LAVACA COUNTY, TEXAS NO. 13

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



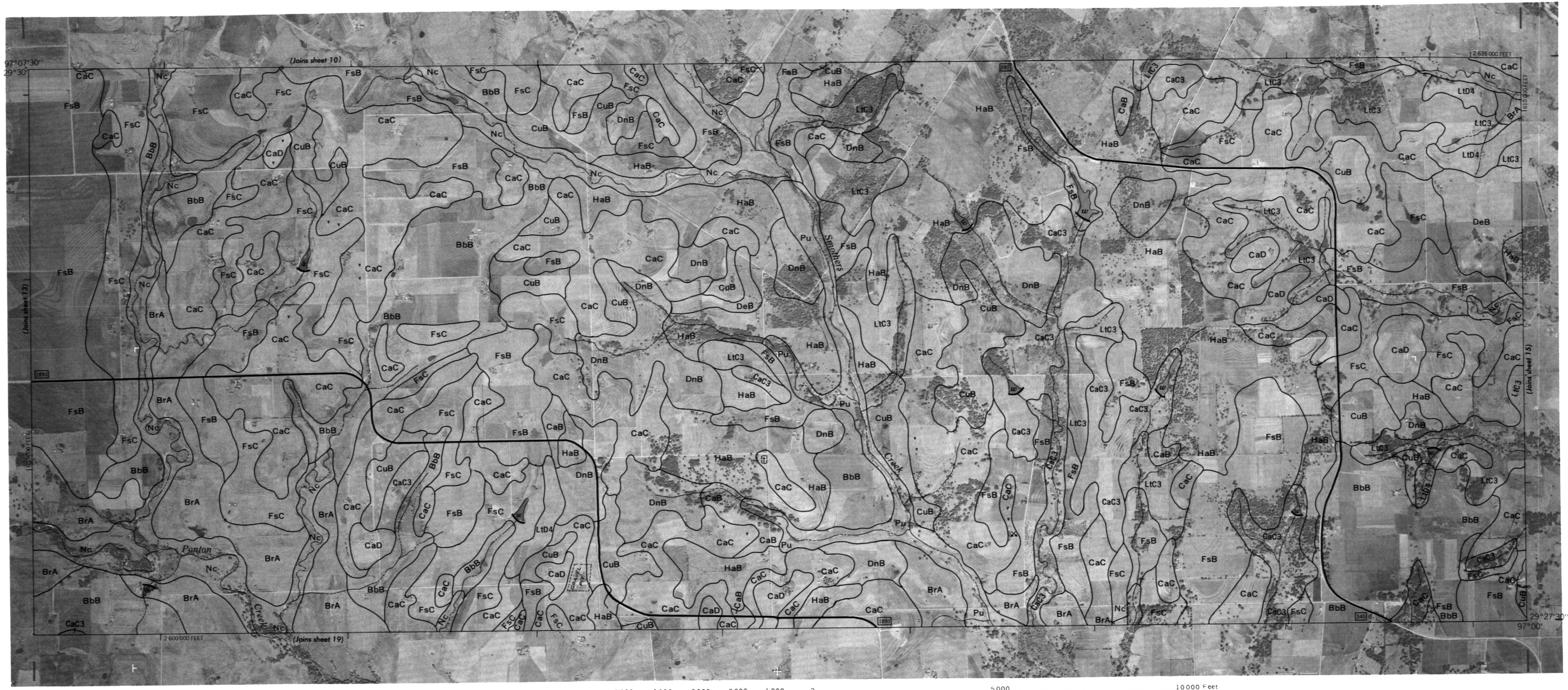
5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale 1:24000

N

LAVACA COUNTY, TEXAS — SHEET NUMBER 14



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

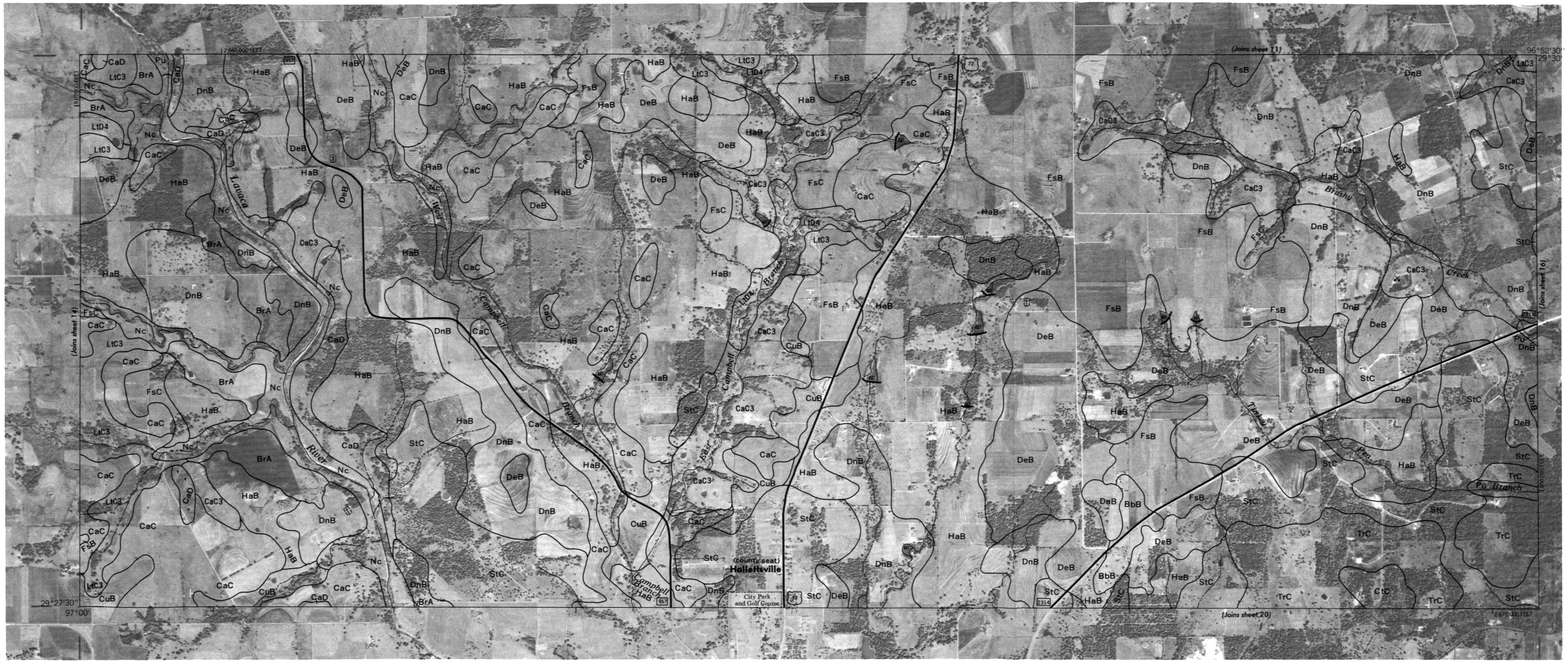
LAVACA COUNTY, TEXAS NO. 14

15

N

LAVACA COUNTY, TEXAS NO. 15

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

N

LAVACA COUNTY, TEXAS — SHEET NUMBER 16

5000 4000 3000 2000 1000 0 5000 10000 Feet

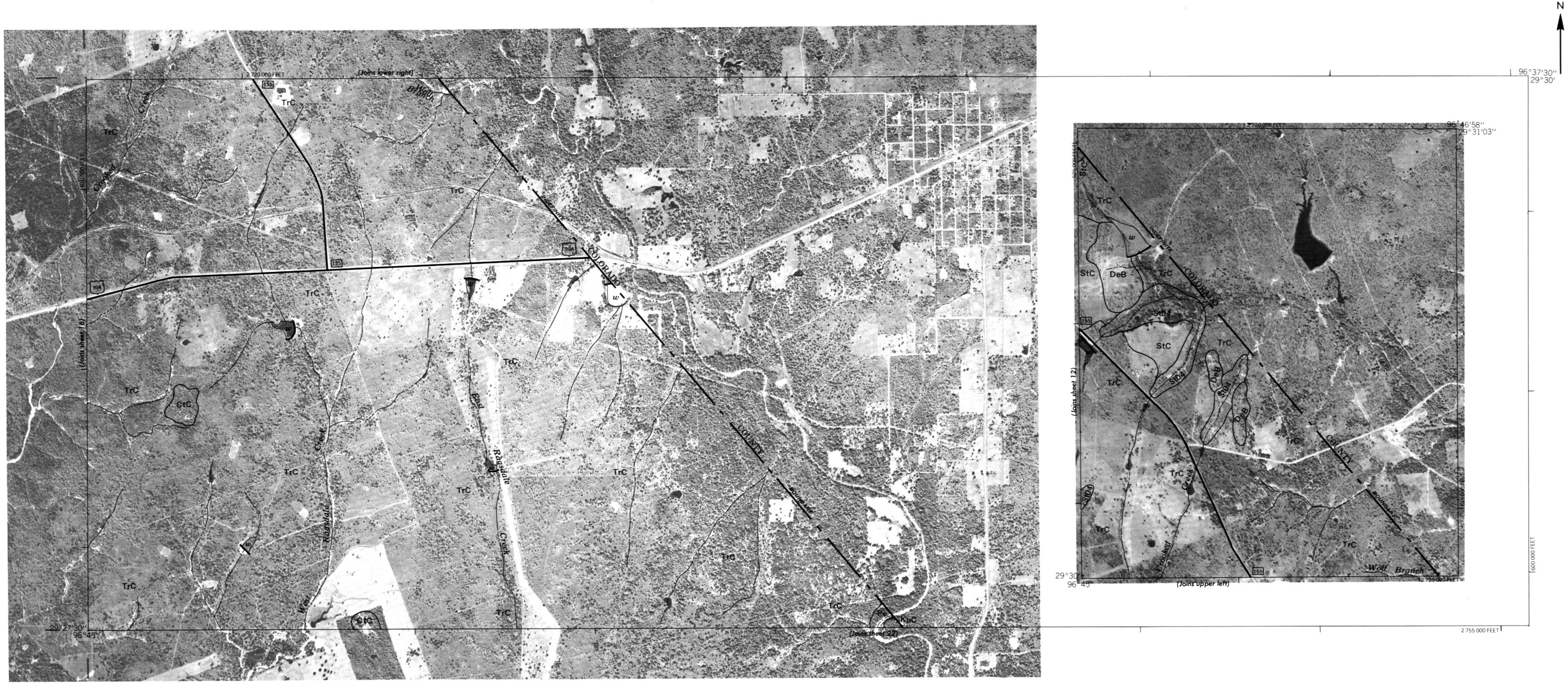
1 .5 0 1 2 3 Kilometers

Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 17

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

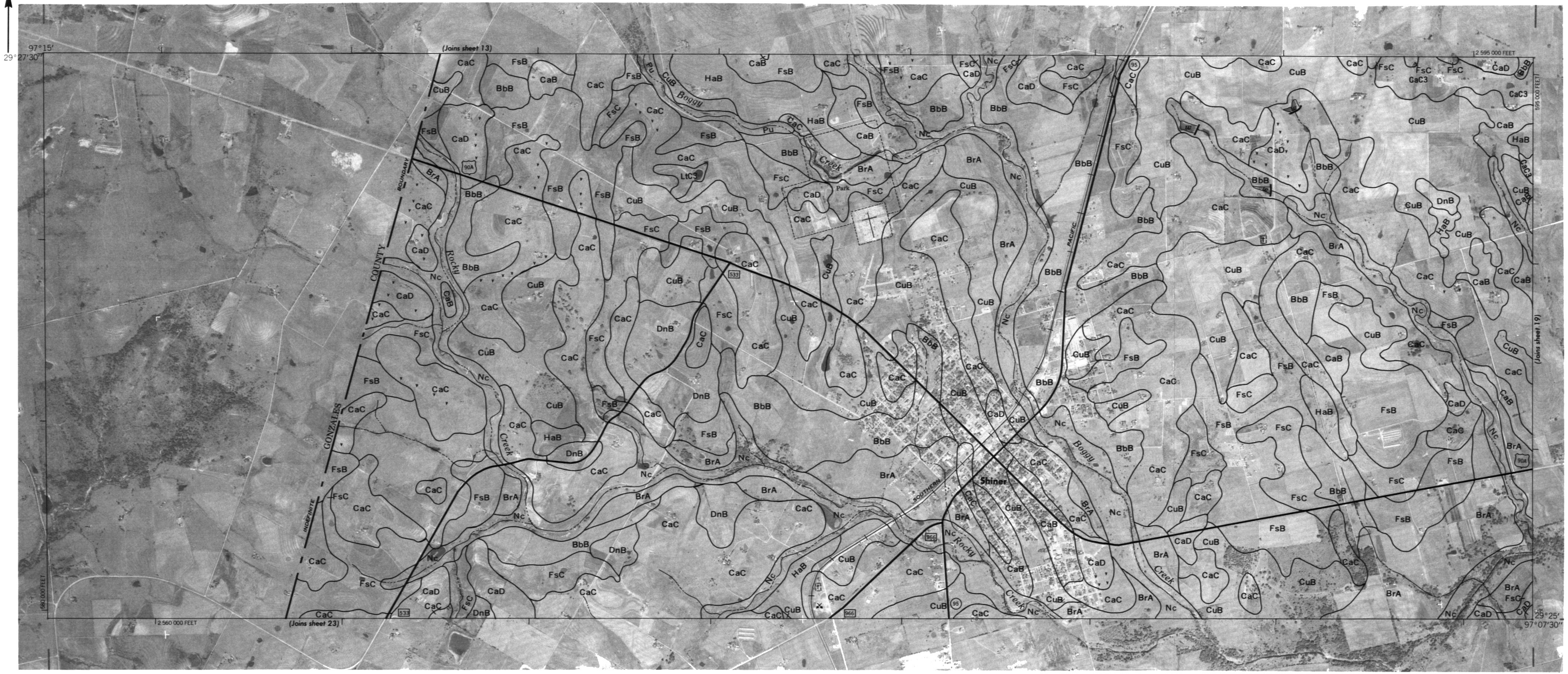


5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

LAVACA COUNTY, TEXAS — SHEET NUMBER 18



5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 18

19

N

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

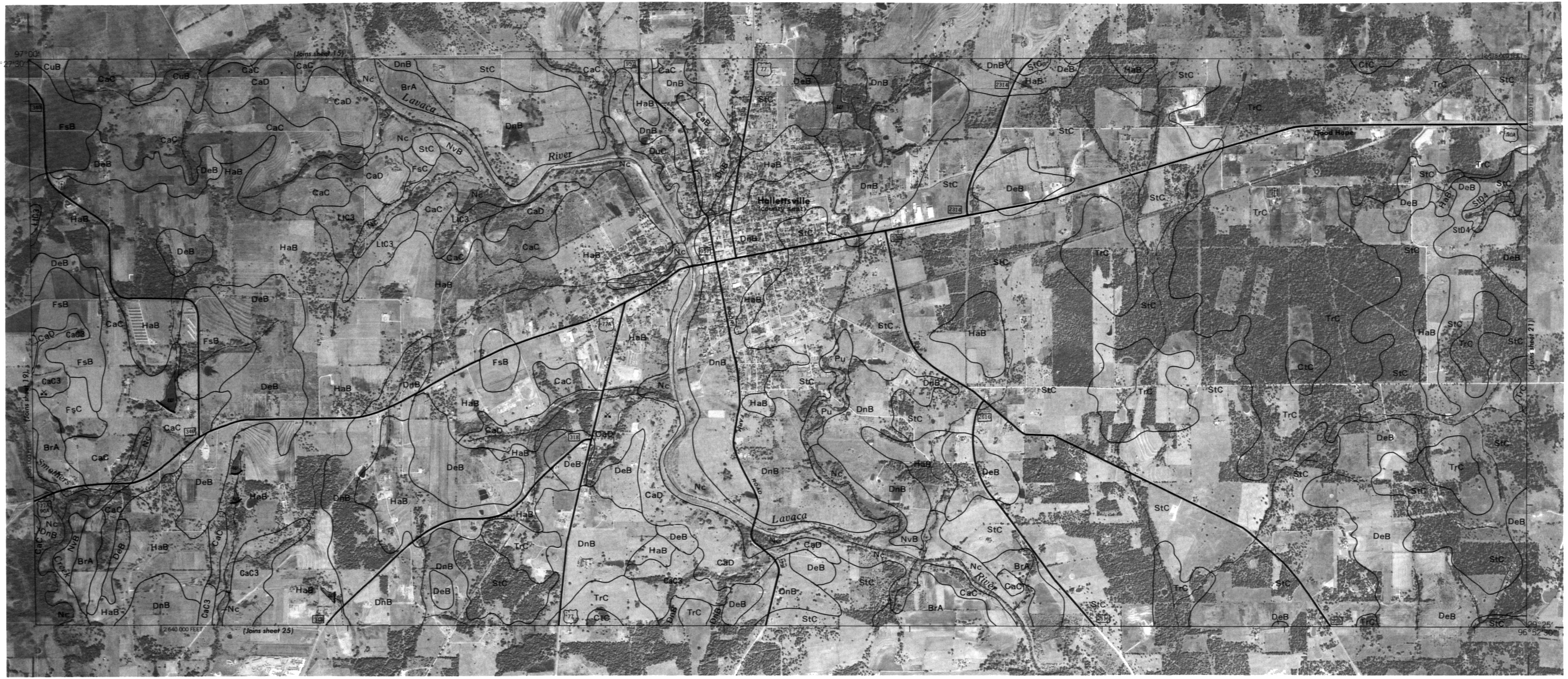
Scale - 1:24000

LAVACA COUNTY, TEXAS NO. 19

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

LAVACA COUNTY, TEXAS — SHEET NUMBER 20



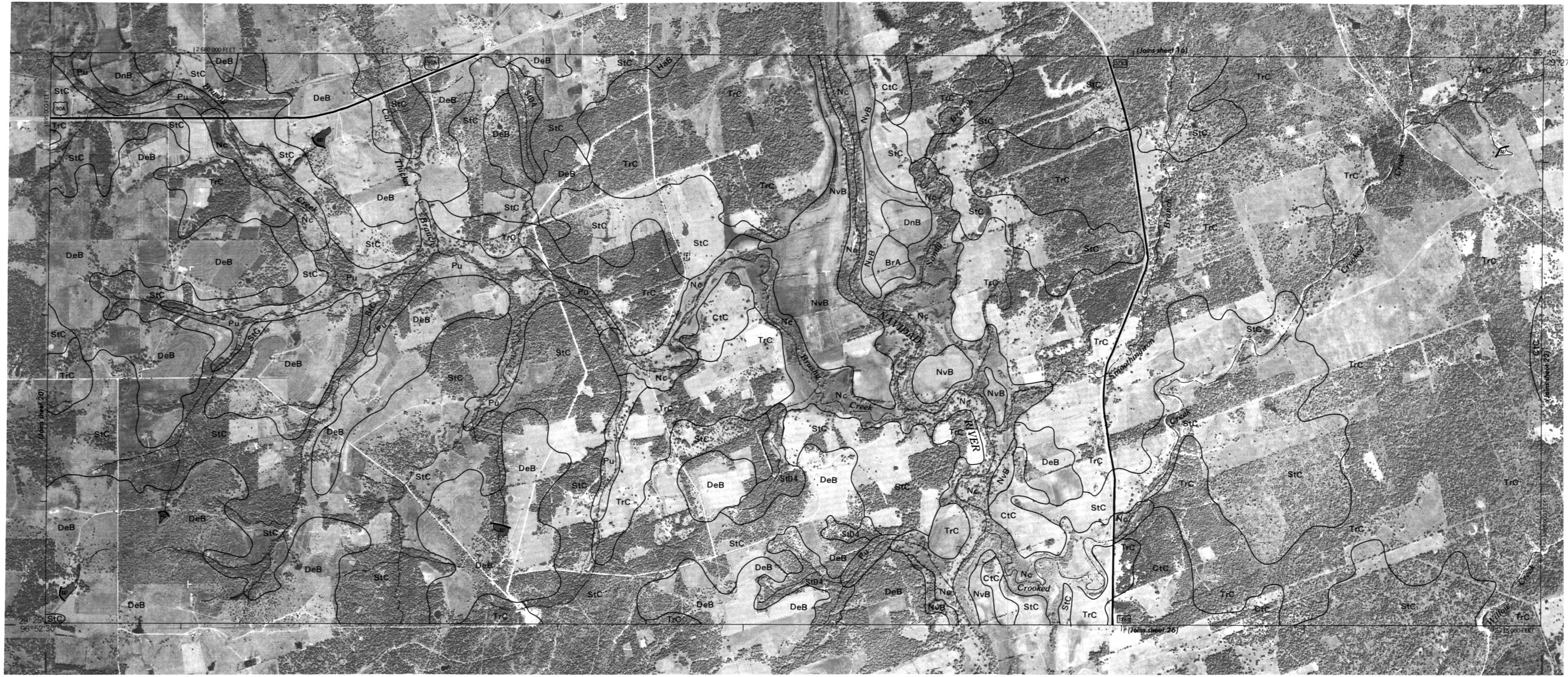
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



5000 4000 3000 2000 1000 0 5000 10000 Feet

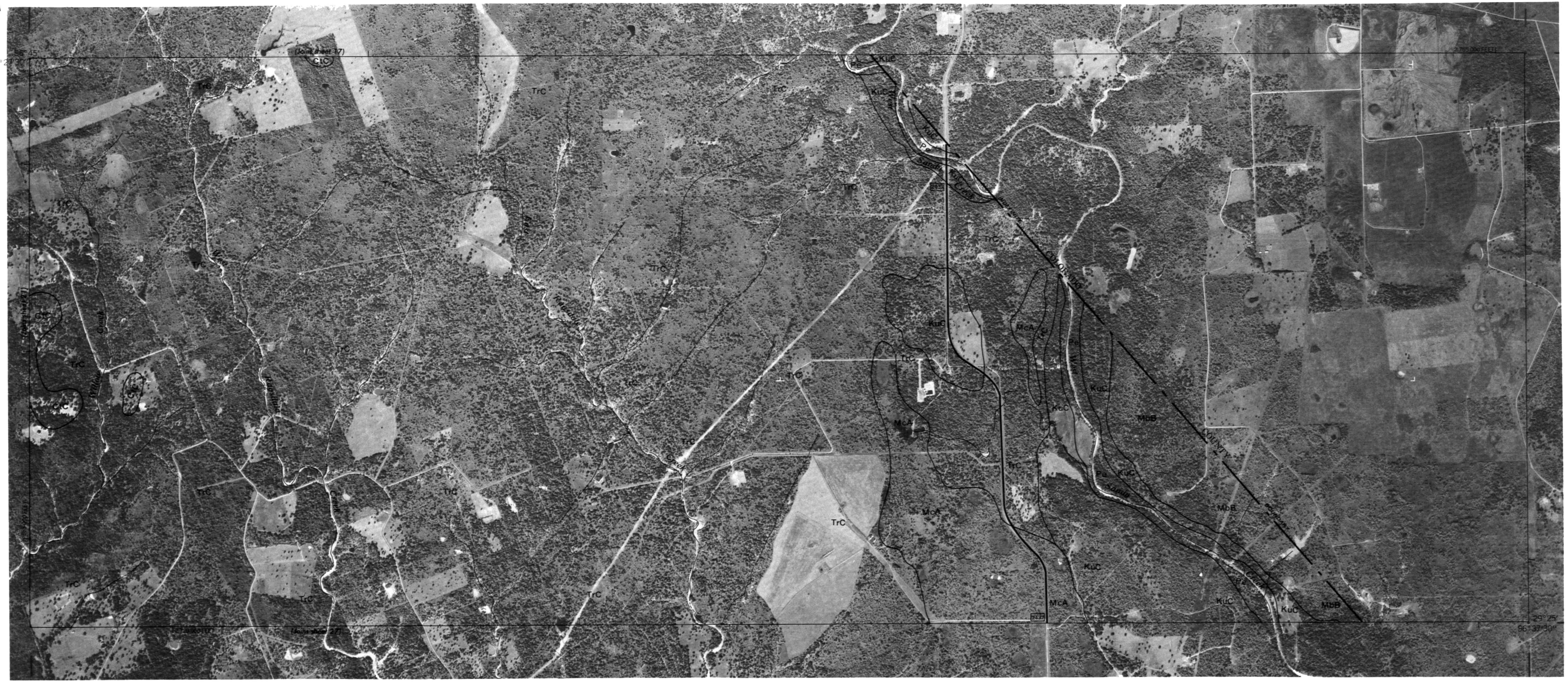
1 .5 0 1 2 3 Kilometers

Scale - 1:24000

(22)

N

LAVACA COUNTY, TEXAS — SHEET NUMBER 22



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 22

LAVACA COUNTY, TEXAS NO. 23

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS — SHEET NUMBER 24

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 24

LAVACA COUNTY, TEXAS NO. 25

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

N

LAVACA COUNTY, TEXAS — SHEET NUMBER 26

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 5 0 1 2 3 Kilometers

Scale - 1:24 000

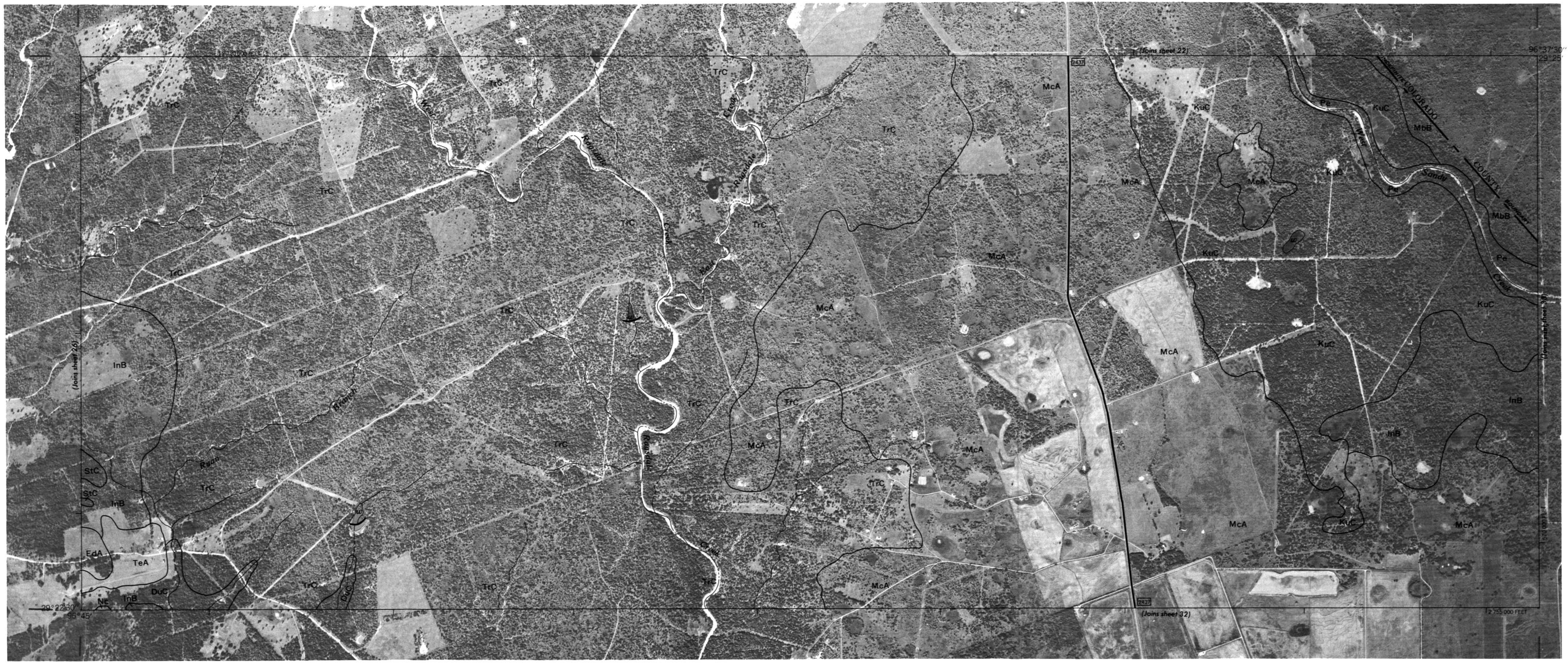
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 26

N

LAVACA COUNTY, TEXAS NO. 27

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

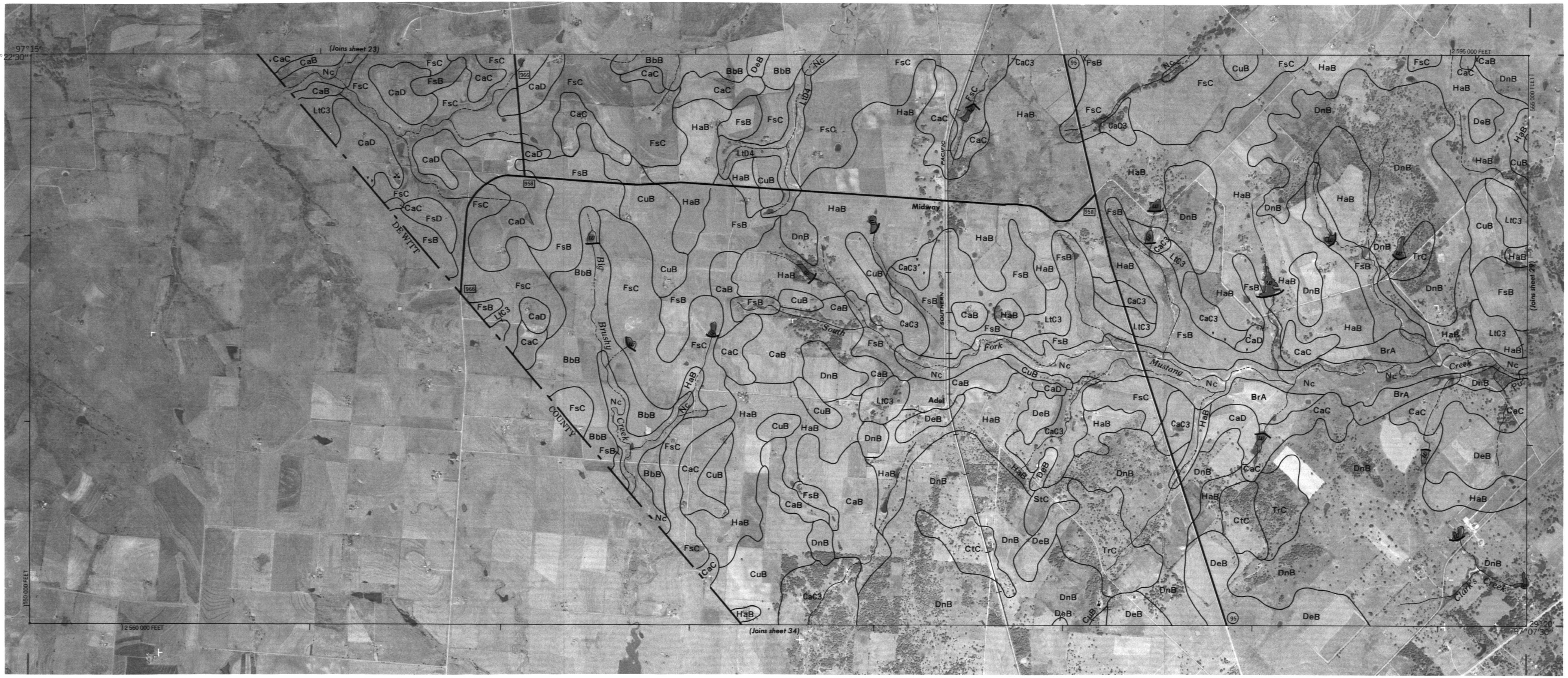


5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

N



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 29

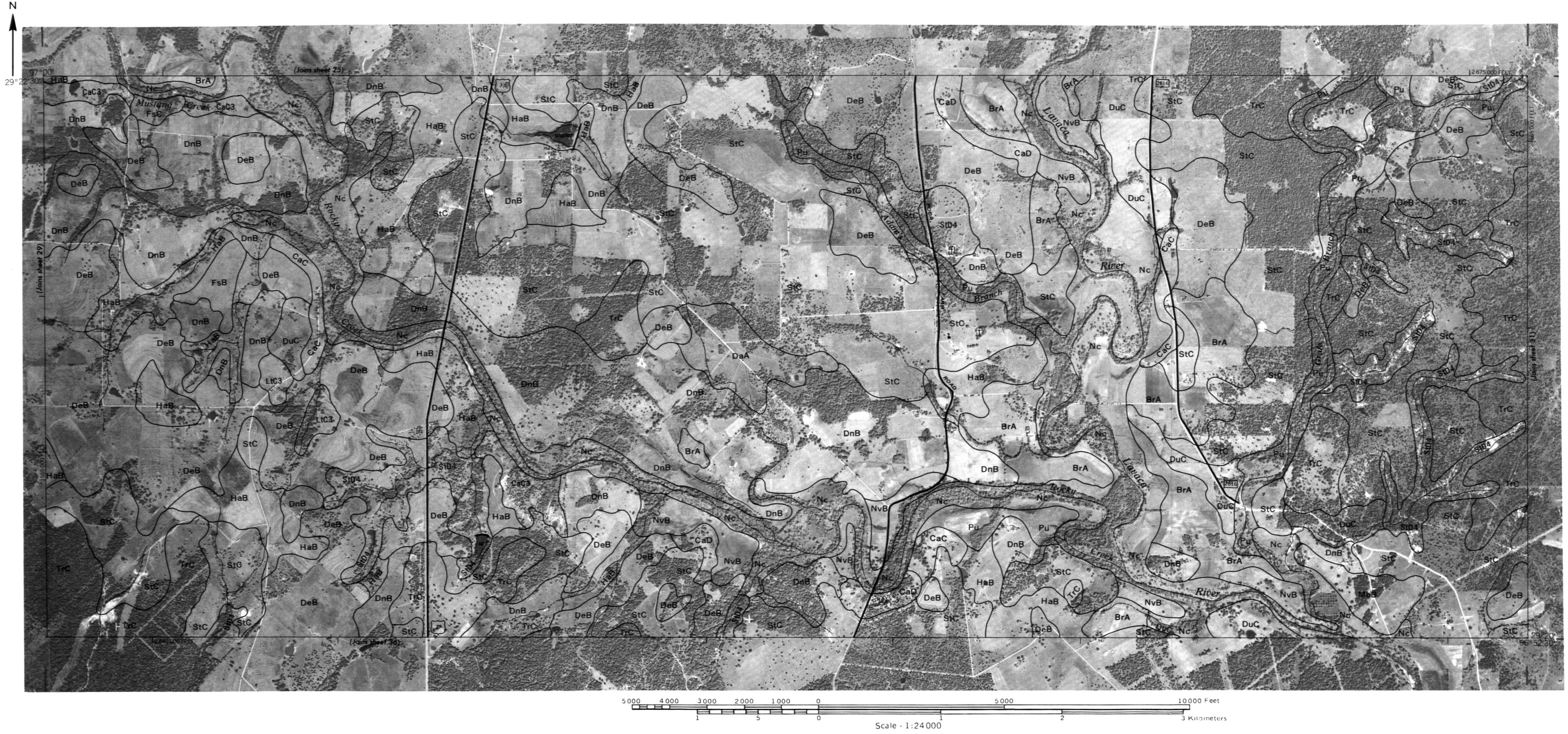
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000



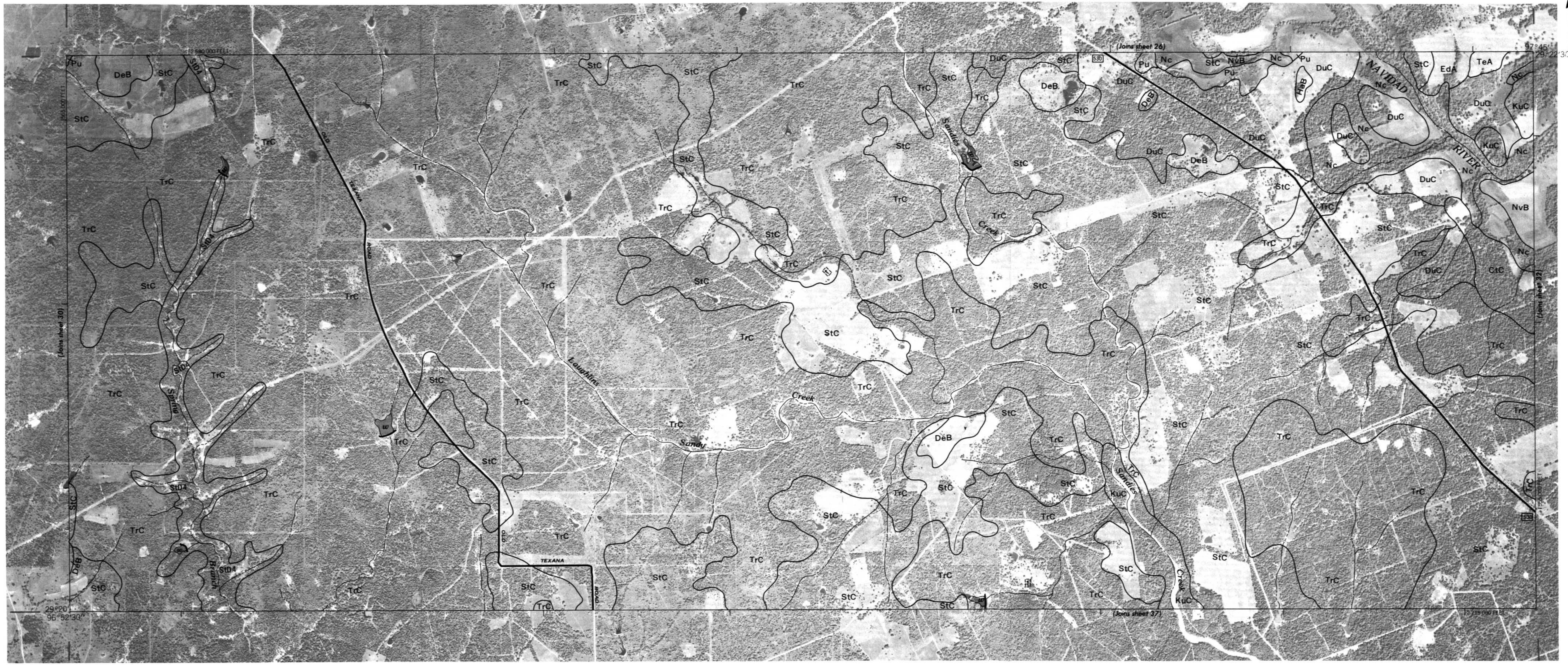
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 30

31

LAVACA COUNTY, TEXAS NO. 31

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

LAVACA COUNTY, TEXAS — SHEET NUMBER 32

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

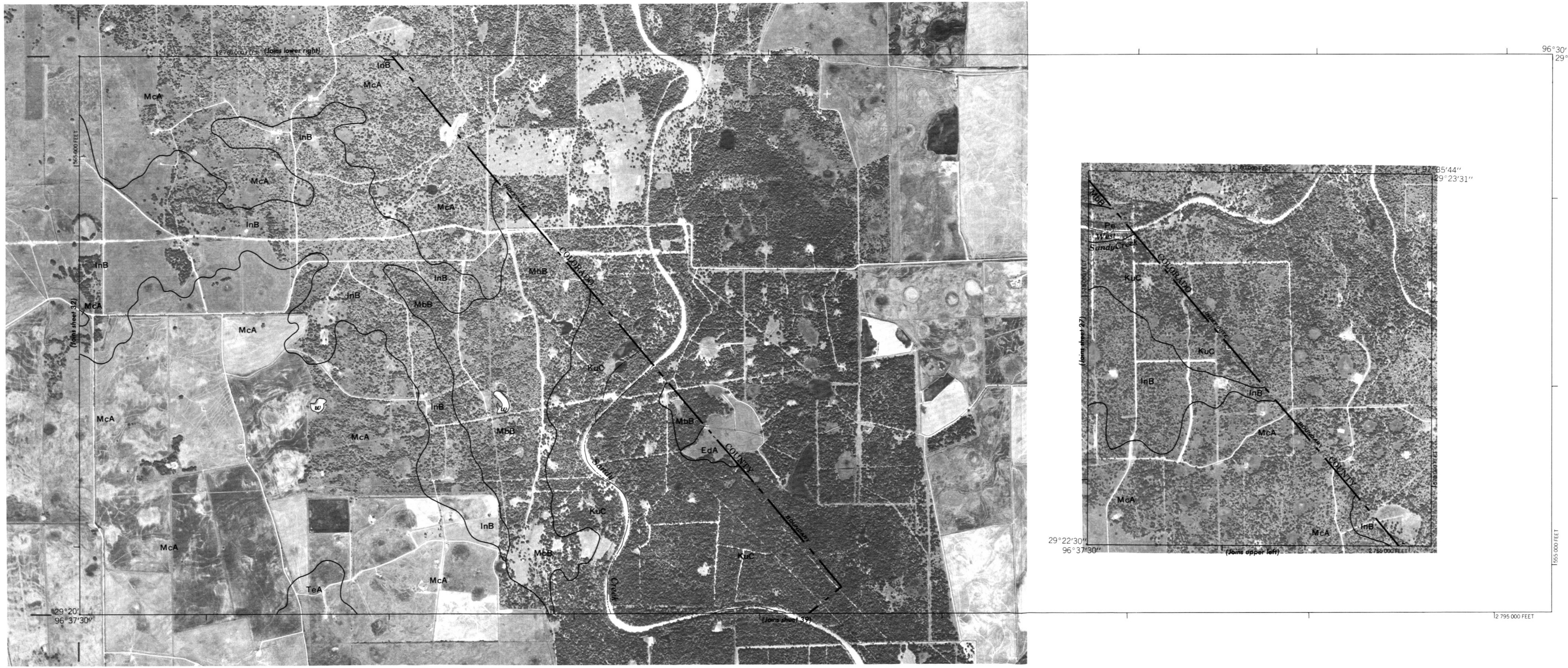
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

33

N

LAVACA COUNTY, TEXAS NO. 33

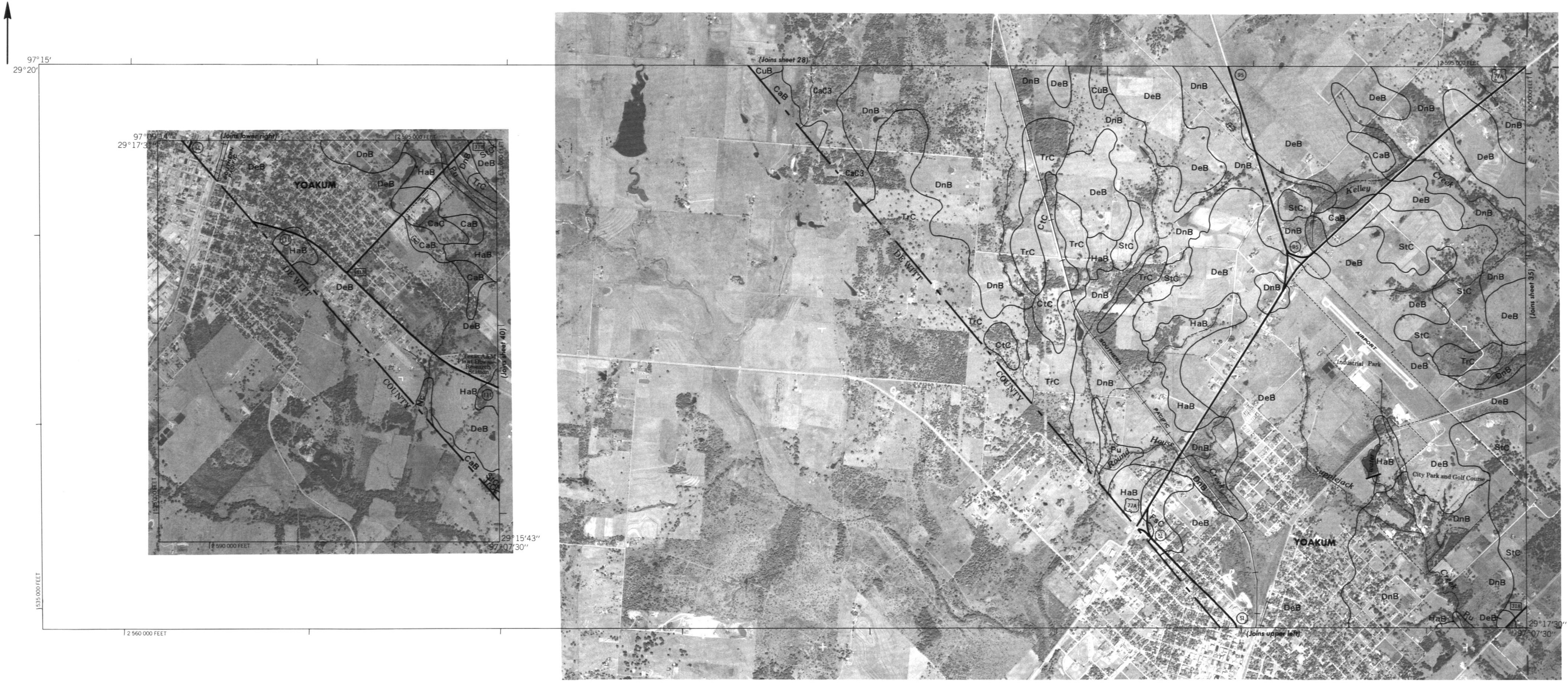
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000



5000 4000 3000 2000 1000 0 5000 10000 Feet

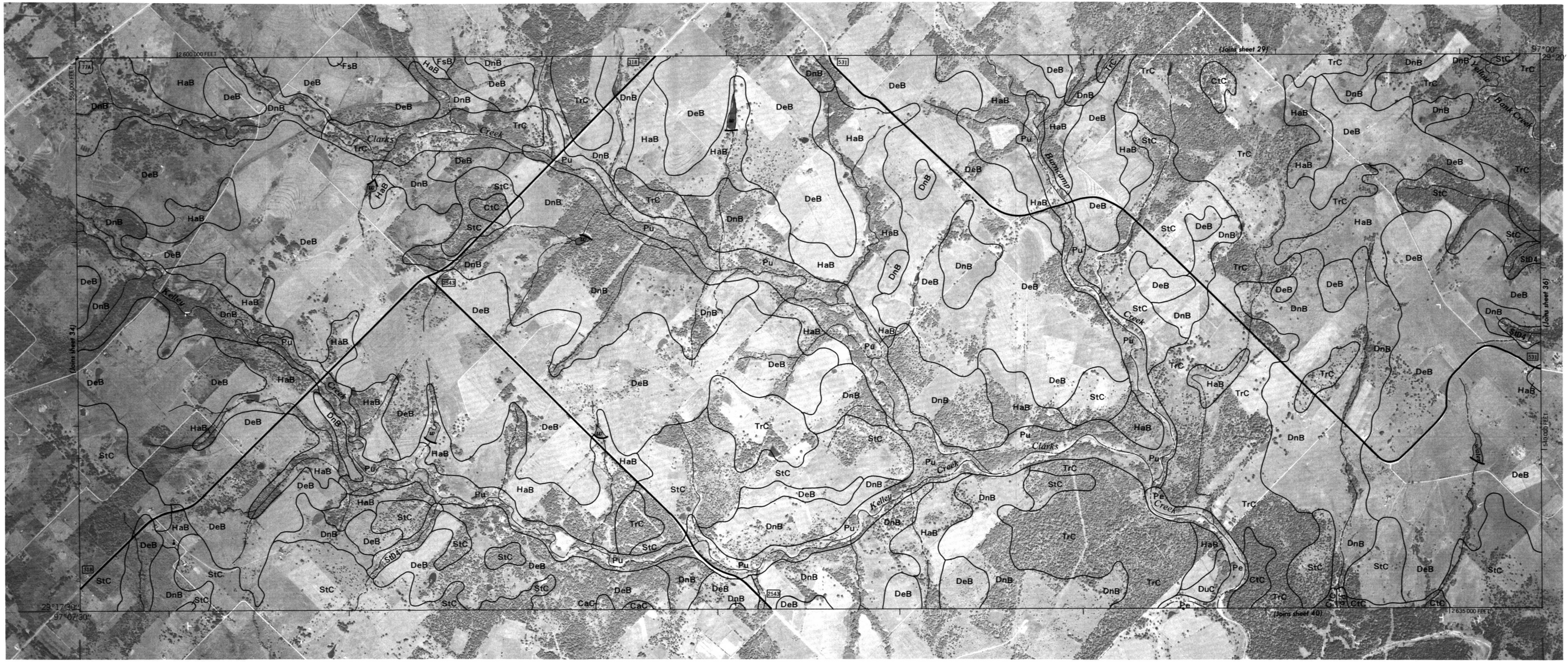
1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

35

N



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

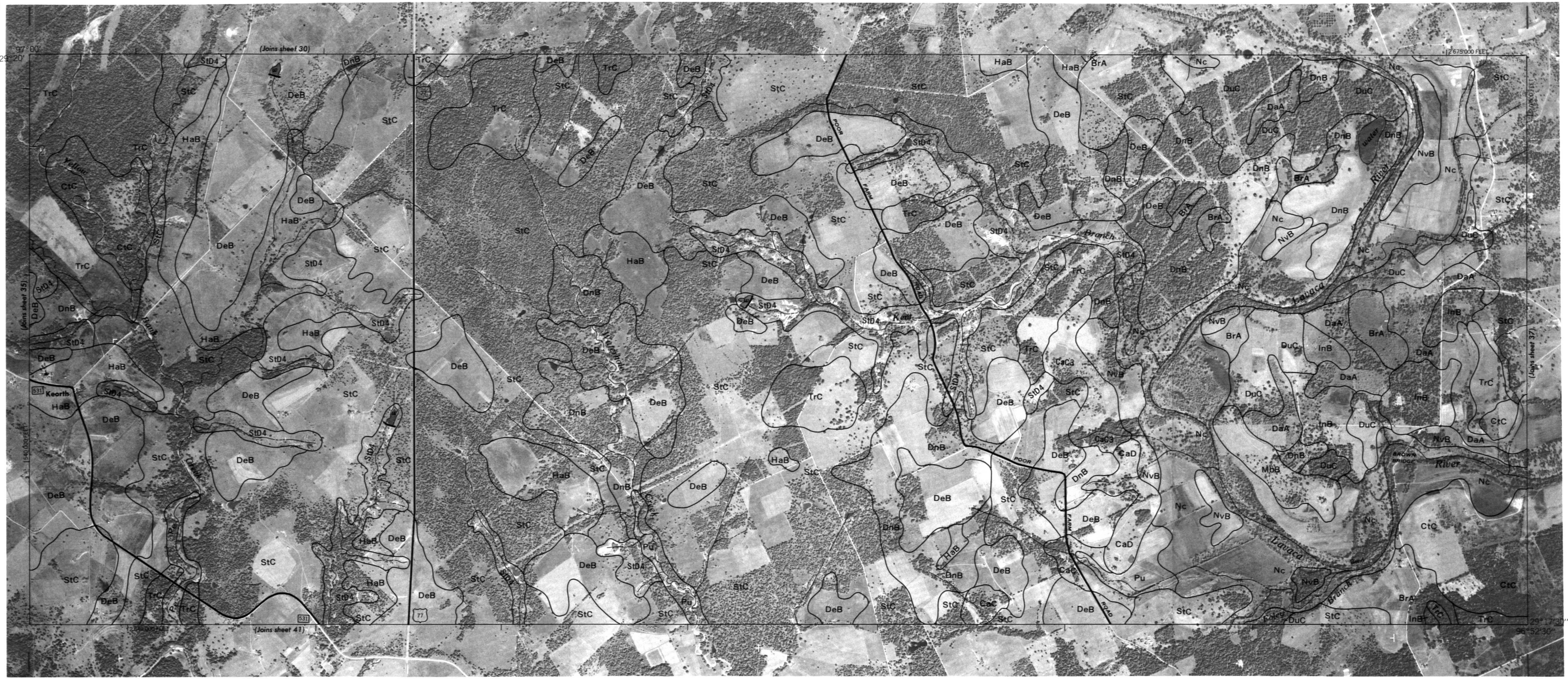
Scale - 1:24000

LAVACA COUNTY, TEXAS NO. 35

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981–1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS — SHEET NUMBER 36

N



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 36

37

N

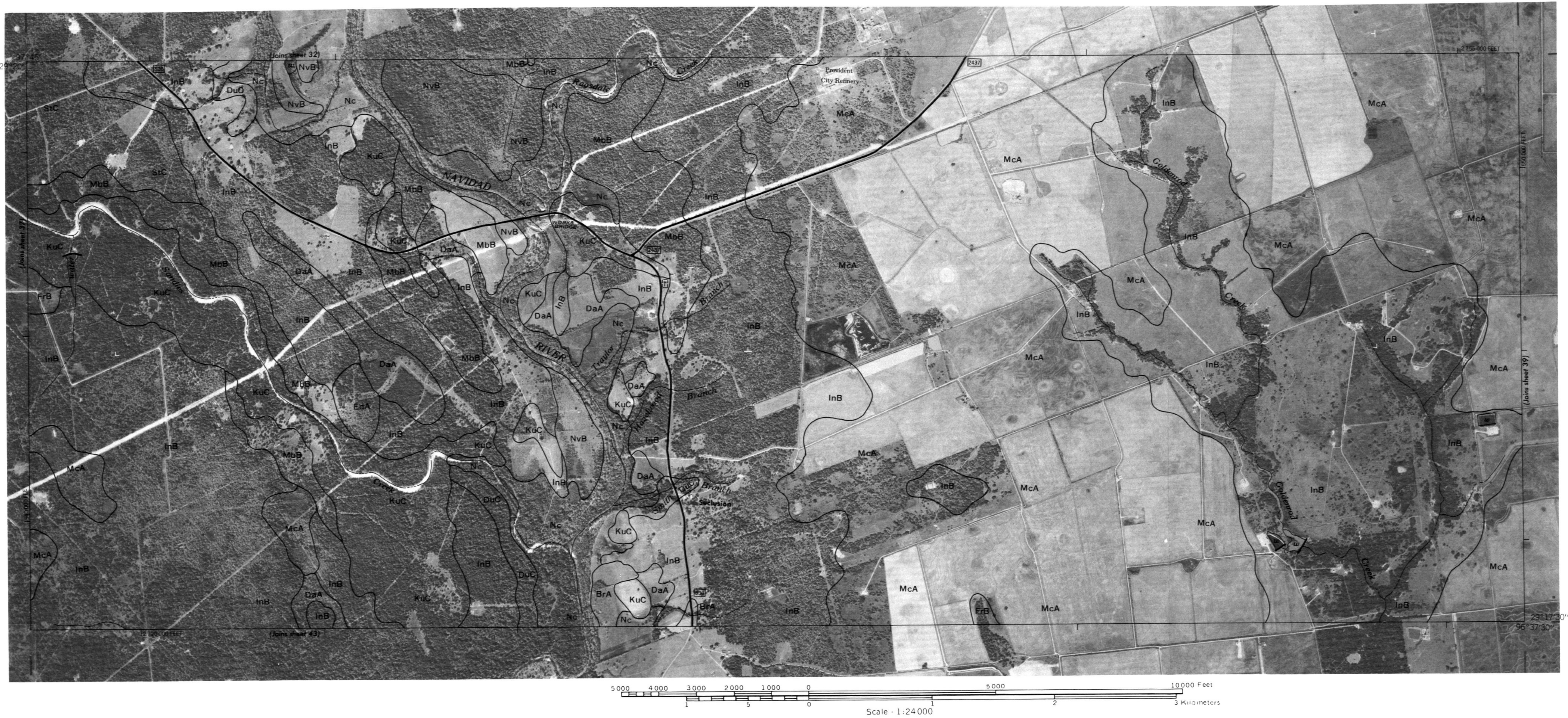
LAVACA COUNTY, TEXAS NO. 37

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

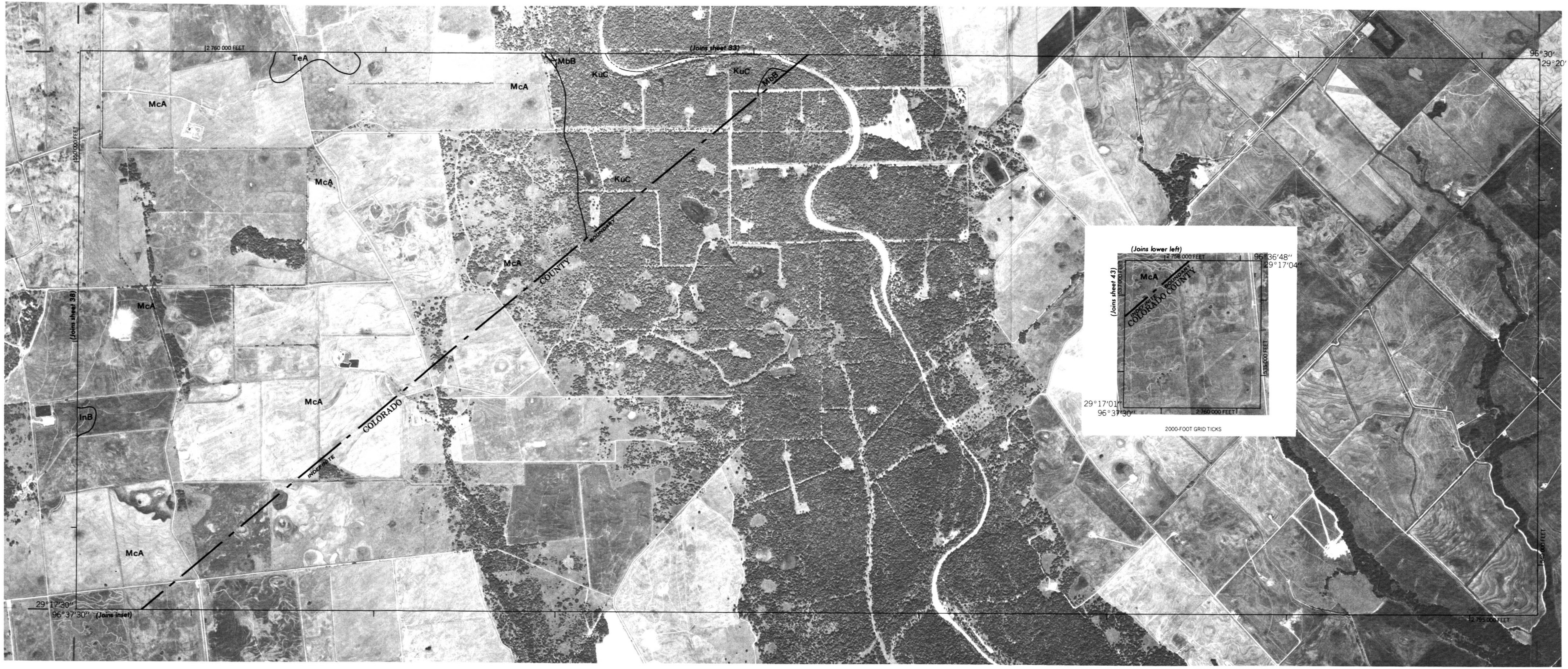


This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 38

LAVACA COUNTY, TEXAS NO. 39

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



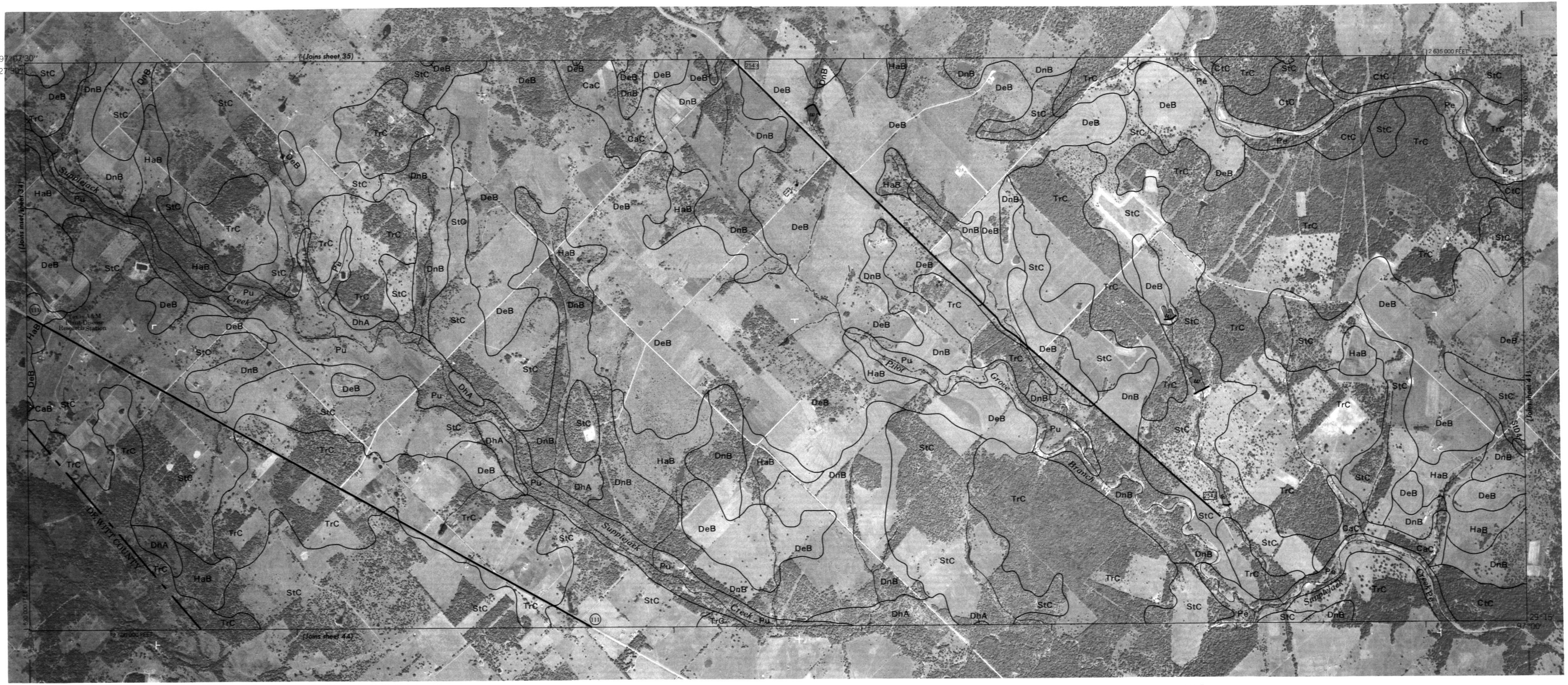
5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

N

LAVACA COUNTY, TEXAS — SHEET NUMBER 40



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 41

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

LAVACA COUNTY, TEXAS — SHEET NUMBER 42

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 42

43

N

LAVACA COUNTY, TEXAS NO. 43

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

N

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

LAVACA COUNTY, TEXAS NO. 45

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

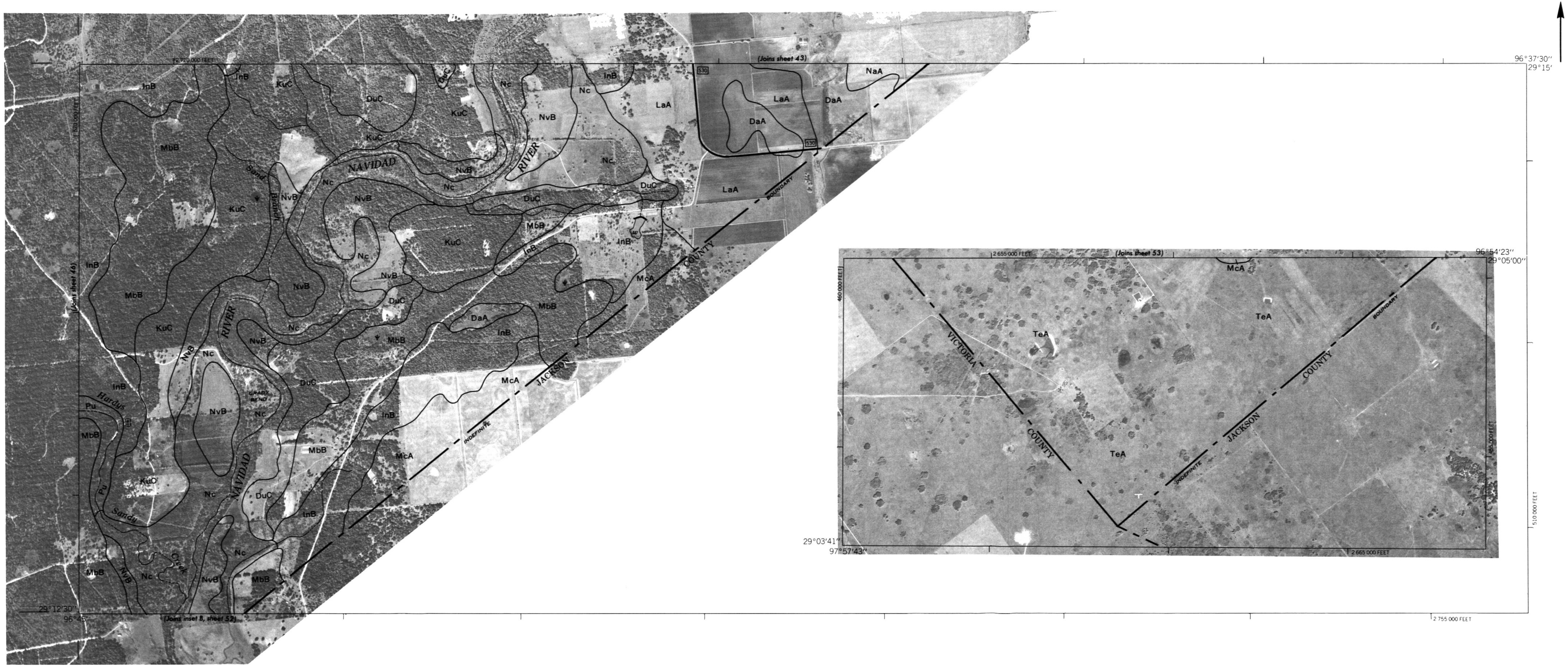
46

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LAVACA COUNTY, TEXAS NO. 46

LAVACA COUNTY, TEXAS NO. 47

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale 1:24 000

N

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

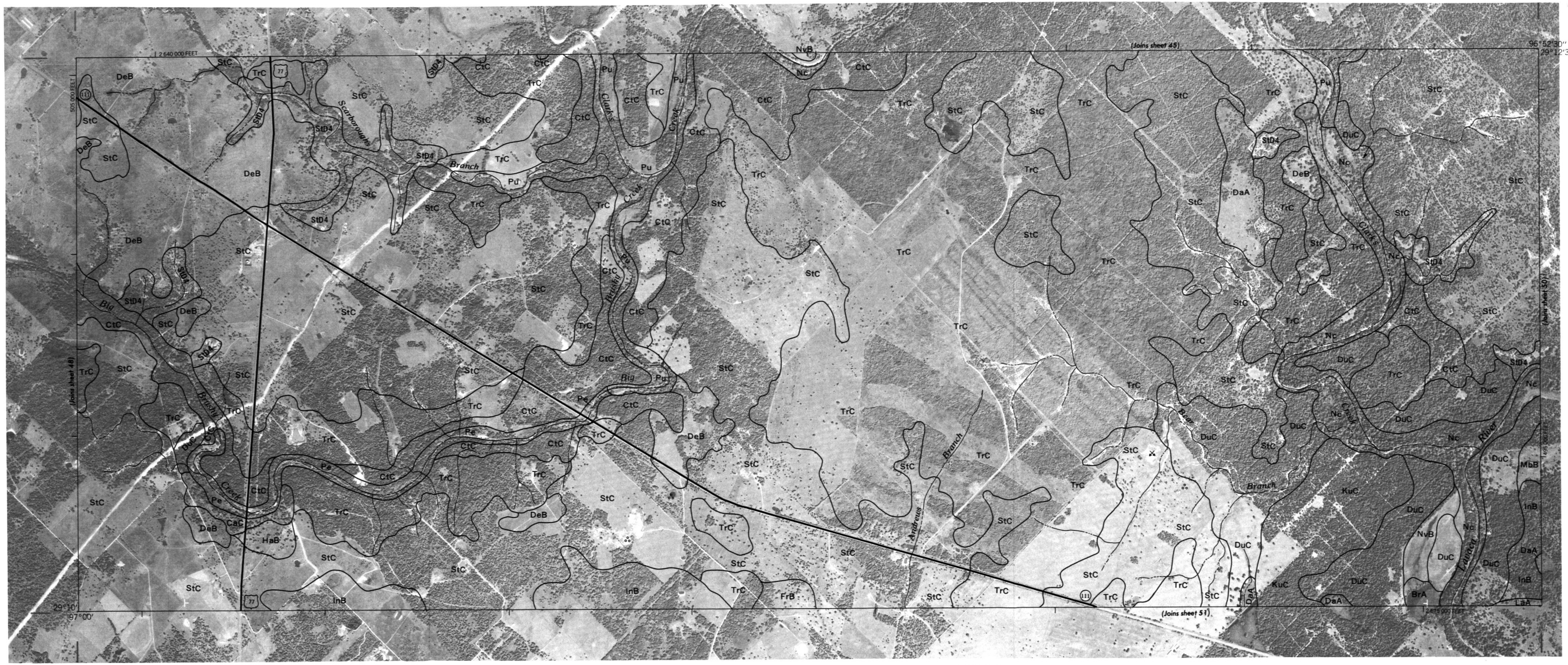
LAVACA COUNTY, TEXAS NO. 48

49

N

LAVACA COUNTY, TEXAS NO. 49

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

N

LAVACA COUNTY, TEXAS — SHEET NUMBER 50

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981–1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

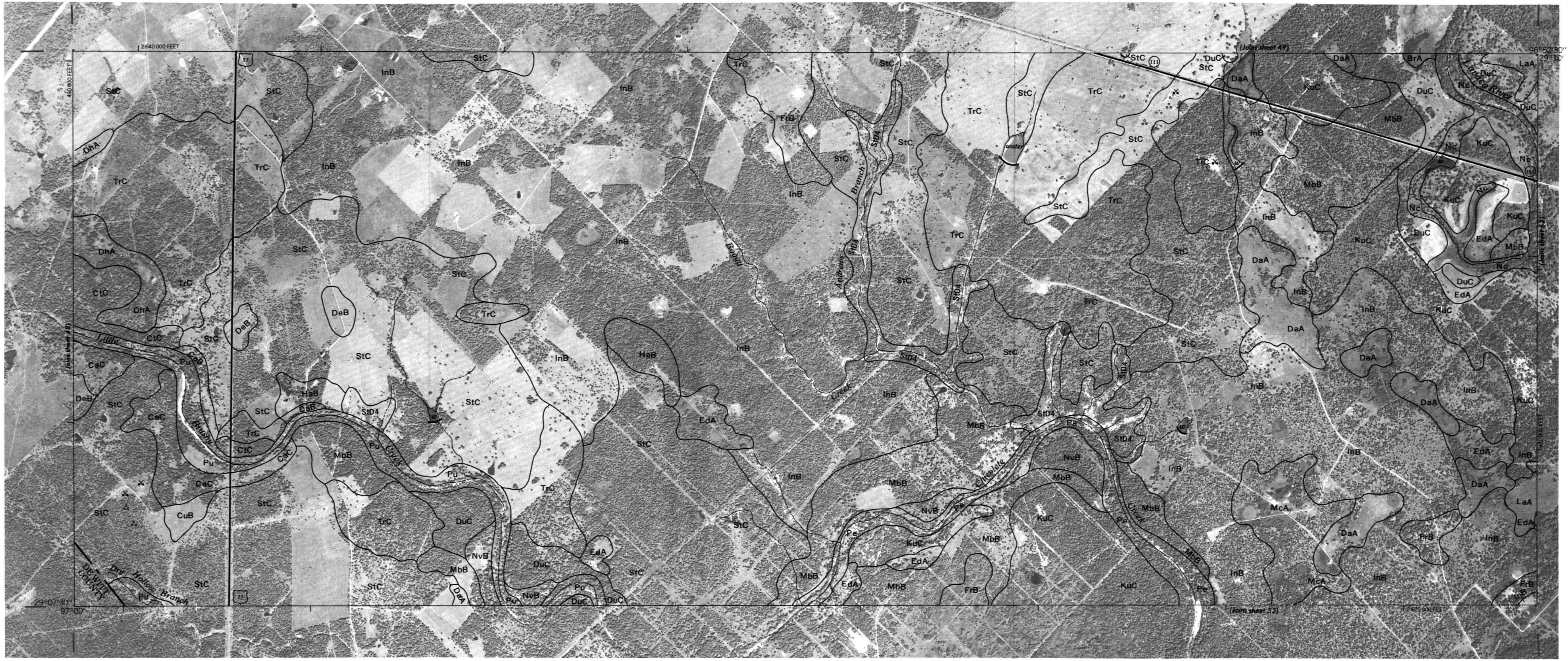
LAVACA COUNTY, TEXAS NO. 50

51

N

LAVACA COUNTY, TEXAS NO. 51

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are from 1981-1982 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.